

Appendix B.

Water quality field survey report (Jacobs 2016a)



Barossa Environmental Studies

ConocoPhillips

Water Quality Field Survey Report

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Barossa Environmental Studies

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Contents

EXECUTIVE SUMMARY 1

1. INTRODUCTION 3

1.1 BACKGROUND 3

1.2 OVERVIEW OF EXISTING REGIONAL ENVIRONMENT 3

1.3 OBJECTIVES 3

2. METHODS 6

2.1 WATER QUALITY SAMPLING SITES 6

2.2 TIMING 6

2.3 WATER COLUMN PROFILES 6

2.4 WATER QUALITY SAMPLING 7

 2.4.1 *Sample collection* 7

 2.4.2 *Sample processing, preservation and storage* 10

 2.4.3 *Sample analysis* 10

 2.4.4 *Data analysis* 10

 2.4.5 *Quality control procedures* 10

2.5 PHYTOPLANKTON AND ZOOPLANKTON 11

3. RESULTS 14

3.1 WATER COLUMN PROFILES 14

 3.1.1 *Depth* 14

 3.1.2 *Dissolved oxygen* 14

 3.1.3 *Salinity* 19

 3.1.4 *Water temperature* 23

 3.1.5 *Turbidity* 27

 3.1.6 *TSS* 31

 3.1.7 *pH* 31

 3.1.8 *Chlorophyll a* 35

 3.1.9 *Hydrocarbons* 38

3.2 WATER QUALITY 40

 3.2.1 *Nutrients and pigments* 40

 3.2.2 *Metals/metalloids* 42

 3.2.3 *Hydrocarbons* 59

 3.2.4 *Naturally occurring radioactive materials* 61

3.3 PHYTOPLANKTON AND ZOOPLANKTON 63

4. DISCUSSION 69

5. REFERENCES 71

APPENDIX A. SBE 19PLUS V2 CALIBRATION CERTIFICATE

APPENDIX B. PLANKTON TRANSECT COORDINATES

APPENDIX C. ANALYTICAL LABORATORY REPORTS

List of Figures

Figure 1-1: Barossa field location	5
Figure 2-1: Water quality sampling site locations	9
Figure 3-1: Dissolved oxygen profiles – winter	16
Figure 3-2: Dissolved oxygen profiles – summer	17
Figure 3-3: Dissolved oxygen profiles – autumn	18
Figure 3-4: Salinity profiles – winter	20
Figure 3-5: Salinity profiles – summer	21
Figure 3-6: Salinity profiles – autumn	22
Figure 3-7: Temperature profiles – winter	24
Figure 3-8: Temperature profiles – summer	25
Figure 3-9: Temperature profiles – autumn	26
Figure 3-10: Turbidity profiles – winter	28
Figure 3-11: Turbidity profiles – summer	29
Figure 3-12: Turbidity profiles – autumn	30
Figure 3-13: pH profiles – winter	32
Figure 3-14: pH profiles – summer	33
Figure 3-15: pH profiles – autumn	34
Figure 3-16: Chlorophyll a profile – winter	36
Figure 3-17: Chlorophyll a profile – autumn	37
Figure 3-18: Hydrocarbon profiles – autumn	39
Figure 3-19: Hydrocarbon profile in Darwin Harbour (winter)	40

List of Tables

Table 2-1: Water quality site coordinates and sampling overview	8
Table 2-2: Analytical limits of reporting (LOR), trigger values and sample storage, preservation and holding times	12
Table 2-3: Analytes and the corresponding analytical laboratory	13
Table 3-1: Water depths of the various sites sampled during the water quality surveys	14
Table 3-2: TSS in surface water at selected sites	31
Table 3-3: Nutrient concentrations at permit area sites	46
Table 3-4: Nutrient concentrations at Evans Shoal sites	47
Table 3-5: Nutrient concentrations at Tassie Shoal sites	48
Table 3-6: Nutrient concentrations at Lynedoch Bank sites	49
Table 3-7: Total metal concentrations at permit area sites	50
Table 3-8: Total metal concentrations at Evans Shoal sites	51
Table 3-9: Total metal concentrations at Tassie Shoal sites	52
Table 3-10: Total metal concentrations at Lynedoch Bank sites	53
Table 3-11: Filtered metal concentrations at permit area sites	54
Table 3-12: Filtered metal concentrations at Evans Shoal sites	56
Table 3-13: Filtered metal concentrations at Tassie Shoal sites	57
Table 3-14: Filtered metal concentrations at Lynedoch Bank sites	58
Table 3-15: TPHs, TRHs and BTEXN at site SP1	60
Table 3-16: TPHs, TRHs and BTEXN at sites SP5-S, SP6-M and SP14-M	60
Table 3-17: Naturally occurring radioactive materials at permit area sites	61
Table 3-18: Naturally occurring radioactive materials at Evans Shoal sites	62
Table 3-19: Naturally occurring radioactive materials at Tassie Shoal sites	62
Table 3-20: Naturally occurring radioactive materials at Lynedoch Bank sites	63
Table 3-21: Composition (%) of phytoplankton at each site – winter, summer and autumn	65
Table 3-22: Composition (%) of zooplankton at each site – winter	66
Table 3-23: Composition (%) of zooplankton at each site – summer	67
Table 3-24: Composition (%) of zooplankton at each site – autumn	68
Table B.1: GPS coordinates of the start and finish of the plankton transects – winter	73
Table B.2: GPS coordinates of the start and finish of the plankton transects – summer	73
Table B.3: GPS coordinates of the start and finish of the plankton transects – autumn	74

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Abbreviations

ALS	Australian Laboratory Services Pty Ltd
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agricultural and Resource Management Council of Australia and New Zealand
AS/NZS	Australian and New Zealand Standards
BETXN	benzene, toluene, ethylbenzene, xylenes (meta-, para- and ortho-xylene) and naphthalene
Bq/L	becquerels per litre
ConocoPhillips	ConocoPhillips Australia Exploration Pty Ltd
GPS	global positioning system
LOR	limit of reporting
MAFRL	Marine and Freshwater Research Laboratory (Murdoch University)
MRL	minimum reporting limit
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure(s)
NORM	naturally occurring radioactive material
NT	Northern Territory
NTU	nephelometric turbidity unit
ppb	parts per billion
PSU	practical salinity unit
QC	quality control
SP1-S	sampling point 1 – near-surface water
SP1-M	sampling point 1 – mid-water
SP1-B	sampling point 1 – near-bottom water
spp	species (plural)
TPH	total petroleum hydrocarbon
TRH	total recoverable hydrocarbon
TSS	total suspended solids
°C	degrees Celsius
µg/L	micrograms per litre

Executive Summary

ConocoPhillips Australia Exploration Pty Ltd (ConocoPhillips) are proposing to develop natural gas resources as part of the Barossa area development, located in waters up to 300 m deep in the Bonaparte Basin, in Commonwealth waters offshore of northern Australia. To develop a robust understanding of the existing marine environmental values of the area to inform any future approvals, a targeted baseline marine studies program is being progressed within and surrounding the Barossa field.

A key component of the baseline marine studies program is a series of water quality surveys during different seasons over a 12-month period. This report summarises the results of the final water quality survey and discusses the results of the three seasonal surveys overall. The seasonal water quality surveys took place during 26–29 June 2014 (winter, or tropical dry season), 18–20 January 2015 (summer or tropical wet season) and 12–15 April 2015 (autumn or tropical transitional).

Seventeen water quality sampling sites were positioned to provide representative coverage of the permit area and areas of regional interest such as shoals and banks. Sites were located in the permit area (five sites, labelled SP1 to SP5), around Evans Shoal (four sites, SP7 to SP10), around Tassie Shoal (four sites, SP11 to SP14), around Lynedoch Bank (three sites, SP15 to SP17) and between the permit area and Evans Shoal (one site, SP6). Sampling sites ranged in depth from around 10 m–30 m on top of shoals and banks through to approximately 280 m in the permit area.

At each site, physico-chemical profiles of the water column were obtained for dissolved oxygen, salinity, temperature, turbidity, pH, chlorophyll *a* and hydrocarbons. Water samples were collected at each site from three depths — near-surface (0–5 m), mid-water and near-bottom (within 5 m of the seabed) — for analysis of nutrients, metals/metalloids, hydrocarbons and naturally occurring radioactive materials (NORMs). Phytoplankton and zooplankton samples were obtained using 20 µm mesh (300 mm diameter) and 100 µm mesh (500 mm diameter) plankton nets, respectively. All water samples were collected, handled, preserved and had holding times in accordance with the recommendations of the Australian and New Zealand Standards (AS/NZS 5667.1:1998).

Autumn survey results were comparable to those recorded during previous (summer and winter) surveys, confirming general patterns, trends and conclusions from those surveys.

Key conclusions from the three seasonal water quality surveys include:

- The depth of the autumn thermocline was similar to winter but deeper than summer. During winter (and autumn), atmospheric cooling at the sea surface produces convective overturning of water and strong, continual winds, which cause the depth of the thermocline to be greater.
- Summer, autumn and winter conditions were similar for concentrations of nutrients (nitrate+nitrite and orthophosphate) and certain metals (arsenic, barium, chromium and nickel) increasing with depth, associated with decomposition of organic matter at depth.
- Generally, nutrients were below ANZECC & ARMCANZ (2000b) trigger values for marine tropical waters in the surface water of all sites but above trigger values in the mid-water and bottom water of the deepest sites. Nutrients are released when organic compounds decay and oxygen is consumed, which was evident in the bottom water of the deepest sites in the permit area where phosphorus and nitrate concentrations were high and oxygen levels were low.
- No dissolved metal samples exceeded the ANZECC & ARMCANZ (2000a) trigger value for 99% species protection, except for copper in four samples in winter and five samples in summer being slightly higher than the ANZECC & ARMCANZ (2000a) trigger value of 0.3 µg/L.
- Total recoverable hydrocarbons and benzene, toluene, xylenes (meta-, para- and ortho-xylene) and naphthalene were below the laboratory reporting limits at all sites and depths for each season. There was little difference in the hydrocarbon profiles between sites, which indicates a lack of hydrocarbons in the areas sampled.

- Radium²²⁶ and radium²²⁸ were above the minimum reporting limit (MRL) at a number of sites during the three surveys, while thorium²²⁸ was below the MRL. There are no ANZECC & ARMCANZ (2000a) trigger values associated with NORMs but the concentrations detected in these surveys were below the NHMRC & ARMCANZ (2011) drinking water guidelines.
- *Trichodesmium erythraeum* (blue-green alga) was the phytoplankton species captured in highest abundance at most sites during each season. Dinoflagellates were the most diverse group during the autumn survey, whereas diatoms were the most diverse group during summer and winter surveys. The phytoplankton assemblage composition in autumn was similar to summer and winter, although silicoflagellates were only present during winter and cryptomonads were only present during summer and autumn.
- Copepods were the most abundant zooplankton collected during each season. Copepods also displayed the highest species diversity whereas the majority of other Classes contained only one species.

Generally the data collected during the three seasonal surveys were typical of water quality in offshore environments distant from emergent reefs (Gilmour et al. 2013, Heyward et al. 1997) and consistent with our previous observations in deep, offshore waters in the Browse Basin (SKM 2014).

1. Introduction

1.1 Background

ConocoPhillips Australia Exploration Pty Ltd (ConocoPhillips), as proponent on behalf of the current and future joint ventures, are proposing to develop natural gas resources as part of the Barossa area development, located approximately 300 kilometres (km) north of Darwin, Northern Territory (NT).

To facilitate the environmental approvals process for any future development of the Barossa field and surrounds, a robust understanding of the existing state of the key environmental values and sensitivities will be necessary. This understanding will be gained from a series of studies and surveys to assess and monitor the baseline state of environmental factors such as water quality, sediment quality, noise, metocean conditions and benthic habitats within petroleum retention lease permit NT/RL5 (referred to as the 'permit area' in this report) and across a broader geographical area. The field studies assessing these factors commenced in June 2014.

1.2 Overview of existing regional environment

The Barossa area is located in the North Marine Region (Department of Sustainability, Environment, Water, Population and Communities 2012), which comprises the Commonwealth waters of the Gulf of Carpentaria, Timor Sea and Arafura Sea as far west as the NT and Western Australian border. The Northern Marine Region contains internationally significant breeding and/or feeding grounds for a number of listed threatened and migratory marine species, including nearshore dolphins, turtles, dugongs, seabirds and migratory shorebirds afforded protection under national legislation and international conventions.

The Timor and Arafura Seas support a variety of shark, pelagic finfish and crustacean species of commercial and recreational game-fishing importance, e.g. trawl and various finfish fisheries. The shelf break and slope of the Arafura Shelf is characterised by patch reefs and hard substrate pinnacles that support a diverse array of invertebrate groups, with polychaetes and crustaceans being the most prolific (Heyward et al. 1997, CEE 2002). Surveys indicate that between 50 m and 200 m depth, the seabed consists of predominantly soft, easily resuspended sediments (Heyward et al. 1997, URS 2005, 2007). The diversity and coverage of epibenthos is low and organisms present are predominantly sponges, gorgonians and soft corals (Heyward et al. 1997, URS 2005, 2007).

Numerous shoals (submerged calcareous banks or 'seamounts') exist in the broader region around the permit area; the closest being Evans Shoal, 60 km to the west and Tassie Shoal, 70 km south-west, and Lynedoch Bank, 40 km to the south-east. In addition, the new Oceanic Shoals Commonwealth marine reserve (multiple use zone) lies to the south and south-east of the permit area.

1.3 Objectives

Water quality surveys are a key component of the Barossa marine baseline studies program.

Baseline studies were undertaken with reference to the permit area, as shown in **Figure 1-1**. While this represents the area of primary interest as part of ConocoPhillips' staged field development, the broader surrounds were also characterised, including the nearest seabed features of regional interest to the Barossa area (i.e. Evans Shoal, Tassie Shoal and Lynedoch Bank).

The survey was completed during different seasonal conditions over a 12-month period. The specific objectives of the marine water quality surveys were to:

- determine the water quality of the marine waters within the permit area and in the vicinity of Evans Shoal, Tassie Shoal and Lynedoch Bank
- determine any seasonal variation in water quality.

This report summarises the results of the water quality surveys undertaken in:

- mid to late January 2015 in the northern Australian summer (tropical wet)
- mid-April 2015 during the northern Australian autumn (tropical transitional).
- end June 2014 during the northern Australian winter (tropical dry season).

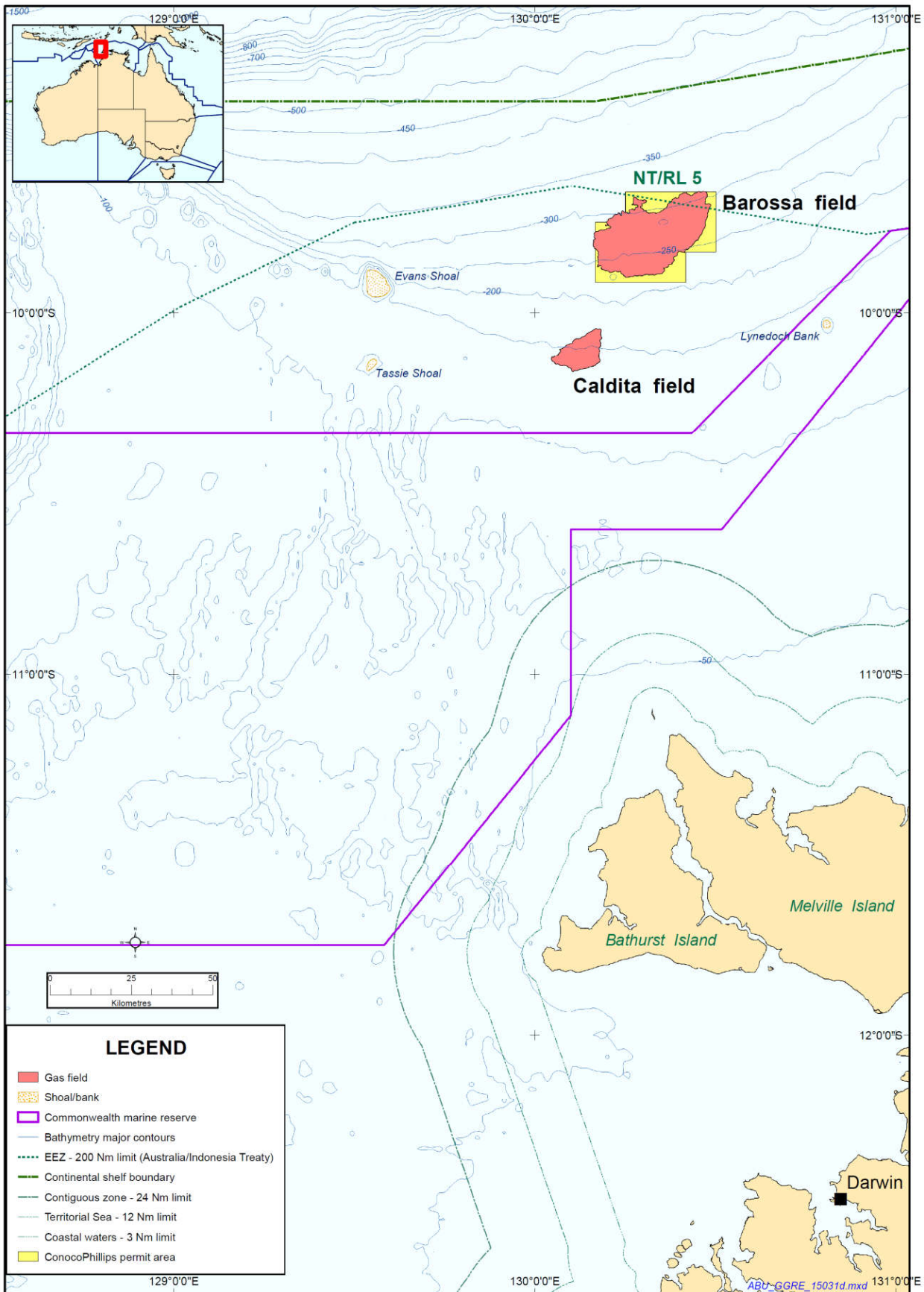


Figure 1-1: Barossa field location

2. Methods

The methods employed during the autumn water quality survey follow those detailed in the *Barossa Environmental Studies: Water Quality Field Sampling Plan Method Statement* (Jacobs 2014). A brief overview of the methods is provided in the sections below.

2.1 Water quality sampling sites

Seventeen sampling sites (**Table 2-1, Figure 2-1**) were positioned to provide coverage of the permit area and of areas of regional interest such as shoals and banks. Sites were located at:

- the permit area (five sites, labelled SP1 to SP5)
- Evans Shoal, approximately 60 km west of the permit area (four sites, SP7 to SP10)
- Tassie Shoal, approximately 70 km south-west of the permit area (four sites, SP11 to SP14)
- Lynedoch Bank, approximately 40 km south-east of the permit area (three sites, SP15 to SP17)
- between the permit area and Evans Shoal, approximately 20 km west of the permit area (one site, SP6).

The number of sites sampled is considered appropriate to characterise the water quality in the permit area and broader surrounds. Some sites were not able to be sampled during each survey (**Table 2-1**). Due to inclement weather during the winter water quality survey, not all of the sites listed above were able to be visited, and therefore sites SP8, SP9, and SP15 to SP17 were not sampled. Due to a malfunction in the zooplankton and phytoplankton equipment during the autumn survey, sites SP2, SP4, SP9, SP12 and SP15 were not able to be sampled.

2.2 Timing

Three water quality surveys were undertaken:

- 26 to 29 June 2014, during the northern Australian (tropical dry) winter
- 18 to 20 January 2015, during the northern Australian (tropical wet) summer
- 12 to 15 April 2015, during the northern Australian (tropical transitional) autumn.

2.3 Water column profiles

At each of the sites sampled during the surveys, physico-chemical profiles of the water column were obtained for:

- dissolved oxygen
- salinity
- temperature
- turbidity
- total suspended solids (TSS) (summer and winter surveys only)
- pH
- chlorophyll *a* (winter and autumn surveys only)
- hydrocarbons.

Parameters were measured using an SBE 19plus V2 SeaCAT profiler (Sea-Bird Electronics) with auxiliary sensors, lowered through the water column at approximately half a metre per second. All sensors were calibrated at the Marine and Freshwater Research Laboratory prior to the field survey commencing. A calibration certificate for each of the sensors can be found in **Appendix A**. Depth was recorded at all sites.

2.4 Water quality sampling

2.4.1 Sample collection

Water samples were collected from three depths at each site, from near-surface (2–5 m), mid-water (half the bottom depth) and near-bottom (within 5 m of the seabed). Samples were collected using 10 L Niskin bottles, arranged in a daisy chain to facilitate the collection of replicate mid-water and near-bottom samples. For surface water samples, a single 10 L Niskin bottle was lowered to 2–5 m below the surface. For sites <30 m deep, only surface and near-bottom water samples were collected.

Table 2-1: Water quality site coordinates and sampling overview

Site name	Water column profiles ³	Nutrients	Metals	Sample type ¹	Hydrocarbons ⁴	Radioactive materials ⁵	Phytoplankton and zooplankton	Latitude	Longitude	Coordinates (DDD° MM' SS.SSS") ²
Permit area										
SP1	✓	✓	✓		✓	✓	✓	9° 43' 30.129" S	130° 28' 54.041" E	9° 43' 30.129" S 130° 28' 54.041" E
SP2	✓	✓	✓		✓	✓	✓#	9° 44' 55.592" S	130° 20' 31.955" E	9° 44' 55.592" S 130° 20' 31.955" E
SP3	✓	✓	✓		✓	✓	✓	9° 45' 43.841" S	130° 10' 48.070" E	9° 45' 43.841" S 130° 10' 48.070" E
SP4	✓	✓	✓		✓	✓	✓#	9° 54' 17.419" S	130° 10' 43.252" E	9° 54' 17.419" S 130° 10' 43.252" E
SP5	✓	✓	✓		✓	✓	✓	9° 53' 17.222" S	130° 24' 19.322" E	9° 53' 17.222" S 130° 24' 19.322" E
SP6 ⁶	✓	✓	✓		✓	✓	✓	9° 48' 44.030" S	129° 58' 5.259" E	9° 48' 44.030" S 129° 58' 5.259" E
Evans Shoal										
SP7	✓	✓	✓		✓	✓	✓	9° 55' 2.690" S	129° 33' 38.636" E	9° 55' 2.690" S 129° 33' 38.636" E
SP8*	✓	✓	✓		✓	✓	✓	9° 57' 7.960" S	129° 32' 5.857" E	9° 57' 7.960" S 129° 32' 5.857" E
SP9*	✓	✓	✓		✓	✓	✓#	9° 56' 21.446" S	129° 36' 11.536" E	9° 56' 21.446" S 129° 36' 11.536" E
SP10	✓	✓	✓		✓	✓	✓	9° 51' 25.533" S	129° 32' 5.302" E	9° 51' 25.533" S 129° 32' 5.302" E
Tassie Shoal										
SP11	✓	✓	✓		✓	✓	✓	10° 7' 59.795" S	129° 33' 0.096" E	10° 7' 59.795" S 129° 33' 0.096" E
SP12	✓	✓	✓		✓	✓	✓#	10° 3' 49.966" S	129° 28' 40.532" E	10° 3' 49.966" S 129° 28' 40.532" E
SP13	✓	✓	✓		✓	✓	✓	10° 11' 44.040" S	129° 39' 46.178" E	10° 11' 44.040" S 129° 39' 46.178" E
SP14	✓	✓	✓		✓	✓	✓	10° 14' 57.851" S	129° 46' 5.394" E	10° 14' 57.851" S 129° 46' 5.394" E
Lynedoch Bank										
SP15*	✓	✓	✓		✓	✓	✓#	10° 0' 30.772" S	130° 46' 39.566" E	10° 0' 30.772" S 130° 46' 39.566" E
SP16*	✓	✓	✓		✓	✓	✓	10° 1' 38.218" S	130° 48' 34.785" E	10° 1' 38.218" S 130° 48' 34.785" E
SP17*	✓	✓	✓		✓	✓	✓	10° 2' 25.991" S	130° 50' 15.953" E	10° 2' 25.991" S 130° 50' 15.953" E

¹ Refer to Section 2.4.2 for full details.

² Datum = GDA94.

³ TSS was only sampled during the summer survey

⁴ Total recoverable hydrocarbons, total petroleum hydrocarbons and BTEXN.

⁵ Naturally occurring radioactive materials (NORMs).

⁶ Located between the permit area and Evans Shoal.

* Sites were not sampled during the winter survey due to inclement weather.

Sites were not sampled during the autumn survey due to equipment malfunction.

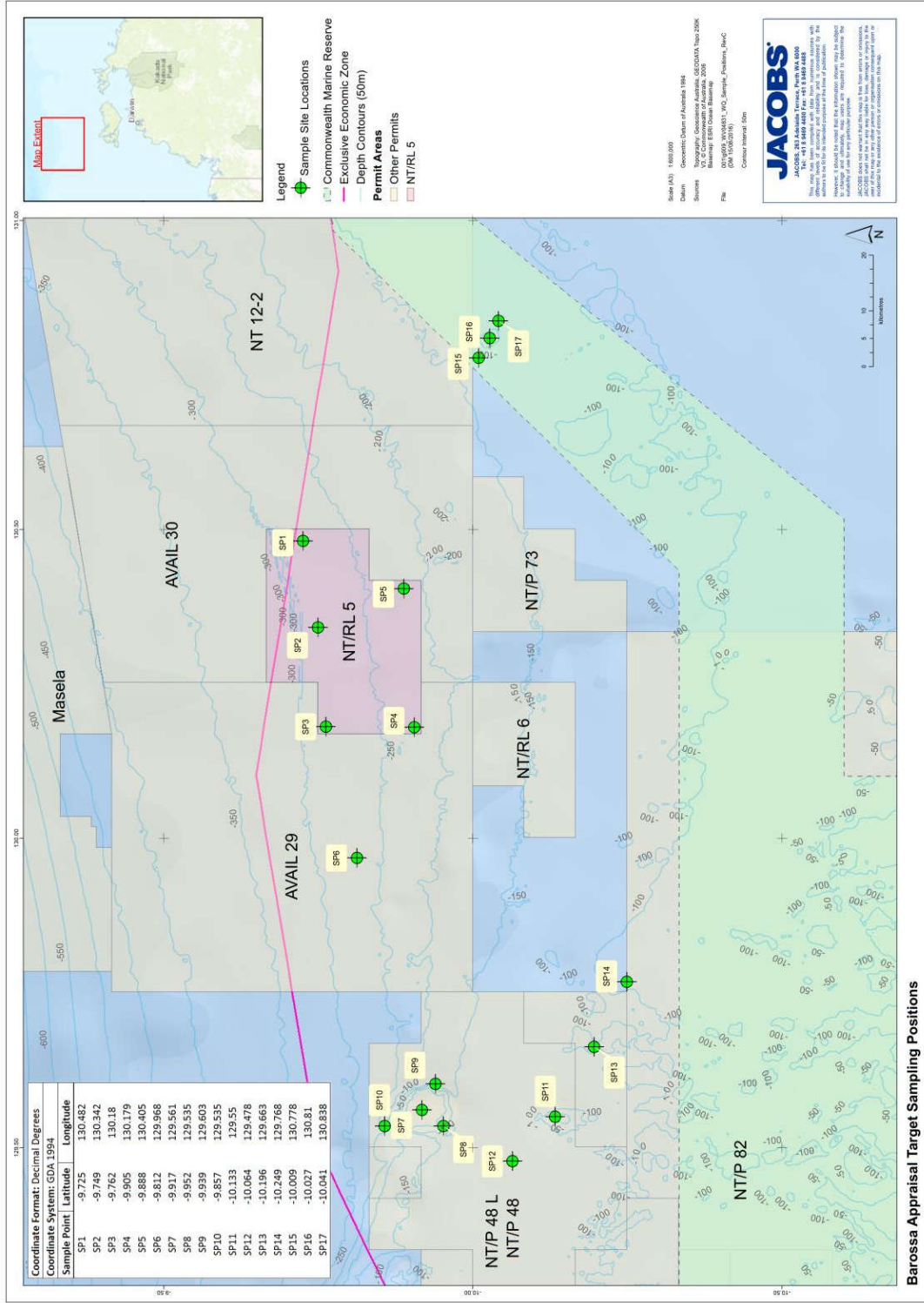


Figure 2-1: Water quality sampling site locations

2.4.2 Sample processing, preservation and storage

All samples were preserved and handled in accordance with Australian and New Zealand Standard (AS/NZS) 5667.1:1998 and with the requirements of the analytical laboratories. The location of the sampling sites was considered remote and therefore the preservation techniques were selected to achieve the maximum allowable holding times for each parameter. For example, the holding time for hydrocarbons is seven days; therefore, these samples were collected late in the survey to allow Jacobs' personnel to transport the samples back to Perth to be hand delivered to the appropriate laboratory in time to meet the holding time requirements.

Samples were stored in laboratory-supplied bottles/containers, with preservatives added where appropriate, and labelled with the site name and depth, the date and the analysis required. All samples collected were recorded on a field sheet and then stored under the required conditions and holding times until delivery to the laboratories (**Table 2-2**). Samples were delivered to the appropriate National Association of Testing Authorities (NATA) accredited laboratories (**Table 2-3**) along with a chain of custody form requesting the analysis required.

Water samples for pigments (chlorophyll *a* and phaeophytin), nutrients and dissolved metals/metalloids were filtered on board the vessel. For pigment samples, 0.2 µm GF/F filter papers were retained and frozen after a known volume of water sample had been filtered. Dissolved nutrient and dissolved metals samples were filtered directly into pre-rinsed sample containers. Nutrient samples were frozen until delivery to the laboratory whereas metals sample bottles had the appropriate acid added prior to sample collection and were then kept cool (approximately 4°C) during transportation.

Hydrocarbon samples were processed on board the vessel by filling sample bottles to the top, leaving minimal air space, and refrigerating until delivery to the laboratory. For the more volatile hydrocarbons (benzene, toluene, ethylbenzene, xylenes (meta-, para- and ortho-xylene) and naphthalene (BTEXN) and total petroleum hydrocarbon (TPH) (C₆–C₉)), sample bottles contained sulfuric acid preservative.

Samples for naturally occurring radioactive materials (NORMs) were processed on board the vessel by adding unfiltered water to sample bottles containing nitric acid as a preservative. Samples were kept cool until delivery to the laboratory.

2.4.3 Sample analysis

Analytes and their respective laboratory limits of reporting (LOR), 99% species protection guideline trigger value (ANZECC & ARMCANZ 2000a) and low reliability values for contaminants having insufficient data to derive reliable national guidelines (ANZECC & ARMCANZ 2000b) are presented in **Table 2-2**. All analyses were undertaken using standard methods at NATA-accredited laboratories.

2.4.4 Data analysis

Nutrient and pigment values were compared to ANZECC & ARMCANZ (2000b) trigger values for Western Australian tropical offshore waters, as Northern Territory values were not supplied. All other values were compared to ANZECC & ARMCANZ (2000a) trigger values for marine water with a 99% level of species protection where available. In some cases where no high reliability trigger value was available, low reliability trigger values were used as indicative working levels.

2.4.5 Quality control procedures

To test for potential sample contamination during collection, storage or transport, low analyte concentration water samples were provided by the laboratories to be split in two ways:

- transport blank: to estimate any contamination introduced to the sample during the transportation and storage stage, low analyte water was poured directly into the sample containers at the laboratory with no filtering or handling.
- field blank: to estimate any contamination introduced to the sample during the collection procedure. This involved following the same sampling procedure using the low analyte water instead of the sample seawater.

Quality control procedures that related to the water sampling were:

- sun cream/zinc and any other potential anthropogenic contaminants were avoided by the personnel in contact with the water sampling equipment
- smoking was prohibited in the sampling area
- care was taken to not open the bottles containing nitric acid while bottling or filtering nutrient samples
- as far as possible, the insides of the sample container lids did not come in contact with any potentially contaminated surfaces or substances (such as hands, workbenches or vessel emissions)
- hands did not come into contact with the insides or lip of the bucket or sample bottles, the tip of the syringe or of the syringe filters.

Procedural and record-keeping quality control measures implemented were:

- global positioning system (GPS) waypoints were recorded for all sites sampled from the vessel
- site locations and samples collected were logged onto field sheets
- appropriate chain of custody forms to accompany samples were completed for each laboratory
- any changes to the field procedures were documented.

2.5 Phytoplankton and zooplankton

Phytoplankton and zooplankton samples were collected at selected sites within each location (**Figure 2-1**):

- permit area and surrounds – sites SP1, SP3, SP5 and SP6
- Evans Shoal – sites SP7, SP8 and SP10
- Tassie Shoal – sites SP11, SP13 and SP14
- Lynedoch Banks – sites SP16 and SP17.

At each site, a zooplankton net (100 µm mesh, 500 mm diameter) was towed at a speed of less than one knot behind the vessel along designated transects of approximately 300 m long. GPS coordinates were recorded at the start and end of every tow (**Appendix B**). A phytoplankton net (20 µm mesh, 300 mm diameter) was suspended on the vessel, as 40 L of surface seawater collected at the transect start was poured through the net. A 125 mL 'raw' (not concentrated) sample of seawater was also collected at each of these sites to aid in the identification of phytoplankton species. This phytoplankton method eliminates the potential for species to be excluded from the net due to the speed of the tow coupled with the very fine mesh size.

Once sampling was completed, the phytoplankton sample was rinsed into the cod end of the net with seawater and transferred to a labelled sample container, adding Lugol's solution to a final concentration of 1%. Lugol's was also added to the raw phytoplankton sample to achieve the same final concentration. The zooplankton sample was rinsed into the cod end of the net with seawater and concentrated by pouring the sample into a 100 µm sieve. The contents of the sieve were then washed into a labelled sample container with 75% ethanol. Phytoplankton and zooplankton samples were kept refrigerated in the dark until delivery to the laboratory for taxonomic identification. All samples were accompanied by a chain of custody form requesting the appropriate analysis. The parameters and laboratory used to undertake the analyses are summarised in **Table 2-3**.

Table 2-2: Analytical limits of reporting (LOR), trigger values and sample storage, preservation and holding times

Test parameter	Guideline (µg/L) ¹	LOR (µg/L)	Storage container	Preservation	Holding time
Total nitrogen	140 ⁵	50	Polypropylene	Freeze	1 month
Total phosphorus	10 ⁶	5	Polypropylene	Freeze	1 month
Ammonium	4 ⁶	3	Polypropylene	Filter on site (0.45 µm filter) and freeze	1 month
Nitrate+nitrite	4 ⁶	2	Polypropylene	Filter on site (0.45 µm filter) and freeze	1 month
Orthophosphate	5 ⁶	2	Polypropylene	Filter on site (0.45 µm filter) and freeze	1 month
Chlorophyll a and phaeophytin	0.5-0.9	0.1	Seed envelope	Filter on site (GFF filter) and freeze residue	1 month
TSS	—	0.5	Seed envelope	Filter on site (GFC filter) and freeze residue	1 month
Arsenic	4.5 ²	0.5	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Barium	—	0.5	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Cadmium	0.7	0.1	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Chromium	7.7 ⁴	0.2	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Cobalt	1.0 ³	0.05	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Copper	0.3	0.2	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Mercury	0.1	0.1	Amber glass with Teflon cap liner	Acidify with nitric acid to pH 1 to 2 and add potassium dichromate	1 month
Nickel	7	0.3	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Lead	2.2	0.1	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
Zinc	7	1	Polypropylene	Acidify with nitric acid to pH 1 to 2	1 month
BTEXN	5-500 ²	1-2	Amber glass with Teflon cap liner	Acidify with sulphuric acid and chill to 4°C	1 week
TPH (C ₁₀ -C ₃₆)	7 ²	20-100	Amber glass with Teflon cap liner	Chill to 4°C	1 week
PAHs	0.01-50 ²	0.5-1.0	Amber glass with Teflon cap liner	Chill to 4°C	1 week
Radium ²²⁶	—	0.1 Bq/L	Polypropylene	Acidify with nitric acid to pH 1 to 2	2 months
Radium ²²⁸	—	0.1 Bq/L	Polypropylene	Acidify with nitric acid to pH 1 to 2	2 months
Thorium ²²⁸	—	0.1 Bq/L	Polypropylene	Acidify with nitric acid to pH 1 to 2	2 months

¹ ANZECC & ARMCANZ (2000a) 99% species protection value unless otherwise specified.

² ANZECC & ARMCANZ (2000b) Low reliability trigger value.

³ ANZECC & ARMCANZ (2000a) 95% species protection value.

⁴ ANZECC & ARMCANZ (2000a) Chromium III trigger value.

⁵ ANZECC & ARMCANZ (2000b) winter values (tropical Australian offshore waters)

⁶ ANZECC & ARMCANZ (2000b) summer values (tropical Australian offshore waters)

Table 2-3: Analytes and the corresponding analytical laboratory

Parameter	Laboratory ¹
Total nitrogen (TN), total phosphorus (TP)	MAFRL
Orthophosphate (FRP), nitrate+nitrite (NO _x), ammonium (NH ₄)	MAFRL
Pigments (chlorophyll a and phaeophytin)	MAFRL
Total suspended solids (TSS)	MAFRL
Total petroleum hydrocarbons (TPHs)/total recoverable hydrocarbons (TRHs)	ALS
Benzene, toluene, ethylbenzene, xylenes (meta-, para- and ortho-xylene) and naphthalene (BTEXN)	ALS
Polycyclic aromatic hydrocarbons (PAHs; only where TPHs detected)	ALS
NORMs (radium ²²⁶ , radium ²²⁸ and thorium ²²⁸)	Western Radiation
Trace metals/metalloids (As, Ba, Cd, Cr, Co, Cu, Hg, Ni, Pb, Zn) (filtered and unfiltered)	MAFRL
Phytoplankton – full count Utermohl	Dalcon Environmental
Zooplankton – lowest level Sedgwick-Rafter counting cell	Dalcon Environmental

¹ MAFRL – Marine and Freshwater Research Laboratory, ALS – Australian Laboratory Services.

3. Results

3.1 Water column profiles

3.1.1 Depth

The deepest sites were within the permit area and ranged from 204 m at SP5 in winter to 282 m at SP3 in winter (**Table 3-1**). Water depths at Evans Shoal ranged from shallow (25 m) on top of the shoal at SP7 in autumn to 207 m at SP10 in summer. Depths were generally shallower at Tassie Shoal ranging from 11 m on top of the shoal at SP11 in summer to 108 m at SP12 in winter, and at Lynedoch Bank, where sites ranged from 14 m at SP16 in autumn to 125 m at SP15 in summer.

Table 3-1: Water depths of the various sites sampled during the water quality surveys

Site	Permit area			Site	Evans Shoal			Site	Tassie Shoal			Site	Lynedoch Bank		
	Depth (m)				Depth (m)				Depth (m)				Depth (m)		
	W	S	A		W	S	A		W	S	A		W	S	A
SP1	277	271	274	SP7	27	26	25	SP11	16	11	14	SP15	NS	125	122
SP2	279	281	279	SP8	NS	78	69	SP12	108	101	102	SP16	NS	16	14
SP3	282	281	278	SP9	NS	160	113	SP13	100	99	98	SP17	NS	114	115
SP4	226	224	221	SP10	206	207	200	SP14	100	100	99				
SP5	204	211	210												
SP6	271	270	276												

W = winter, S = summer, A = autumn.

NS = no sample due to inclement weather conditions.

3.1.2 Dissolved oxygen

Winter

The percentages of dissolved oxygen in the surface water at the various sites in and near the permit area (SP1 to SP6) were approximately 96% (**Figure 3-1**). In general, the dissolved oxygen remained fairly constant at 96% to approximately 70 m depth, at which the dissolved oxygen rapidly declined to 50% at approximately 100 m. There was a gradual decline of dissolved oxygen after this point to the lowest level, which was approximately 35% in the bottom water.

The percentages of dissolved oxygen at sites around Evans Shoal and Tassie Shoal, although on the whole shallower than sites in the permit area, still exhibited a similar vertical distribution pattern according to the depth of the site (**Figure 3-1**). For example the dissolved oxygen of the very shallow sites, SP7 and SP11 in less than 30 m depth did not change from top to bottom. At other sites SP12, SP13 and SP14, at approximately 100 m depth, had similar percentages of dissolved oxygen from the surface to 80 m which then declined rapidly to the seabed.

Summer

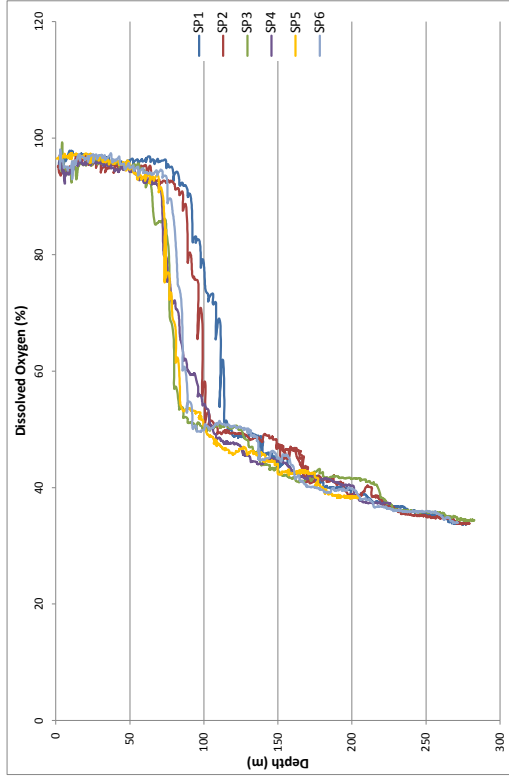
Dissolved oxygen was approximately 90% in the surface water at the various sites in and near the permit area (SP1 to SP6) (**Figure 3-2**). In general, the dissolved oxygen remained relatively constant from the surface to around 45 m deep at most sites and to 60 m deep at SP1 and SP2. There was a rapid decrease in dissolved oxygen at sites SP3, SP4 and SP6 from 90% to 70% at approximately 60 m depth, and then more gradual decline of dissolved oxygen with increasing depth to the lowest level of approximately 32% in the bottom water. Dissolved oxygen at SP5 decreased rapidly from 90% at 45 m to 42% at 80 m, remained constant until 144 m and then rapidly increased to 55% at 150 m, and then gradually declined to 35% in the bottom water. Similar dissolved oxygen profiles were recorded at sites SP5 and SP6 with the pertinent changes generally occurring in slightly deeper waters.

Although generally shallower than the permit area sites, dissolved oxygen at sites around Evans Shoal, Tassie Shoal and Lynedoch Bank exhibited a similar vertical pattern according to the depth of the site (**Figure 3-2**). For example, dissolved oxygen at the shallowest (<30 m deep) sites, SP7, SP11 and SP16, did not change from surface water to bottom water. At the remaining sites, trends in dissolved oxygen profiles were similar, with a layer of relatively constant dissolved oxygen in surface waters followed by a rapid decline from 90% to 50% over approximately 40 m, and then a further gradual decline to the seafloor.

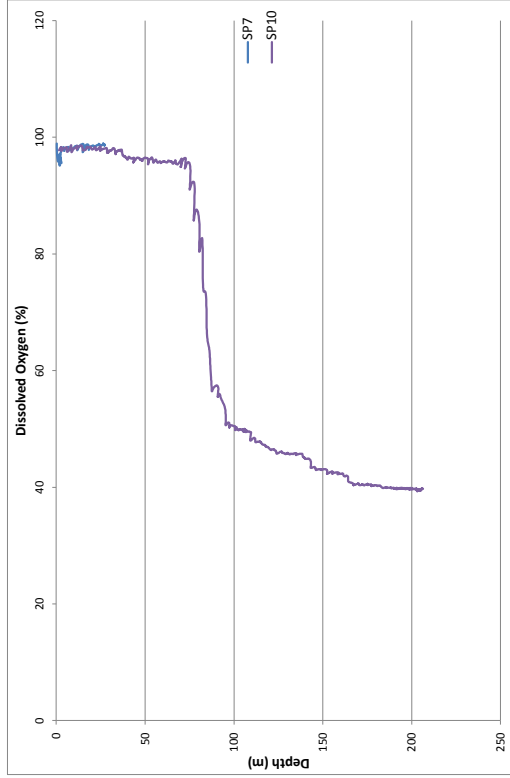
Autumn

Dissolved oxygen saturation was approximately 99% in the surface water at the various sites in and near the permit area (SP1 to SP6) (**Figure 3-3**). In general, the dissolved oxygen remained relatively constant from the surface to approximately 60 m depth at all sites. There was a rapid decrease in dissolved oxygen from 100% to 50% at approximately 100 m and then a more gradual decline of dissolved oxygen with increasing depth to the lowest saturation level of approximately 40% in the bottom water.

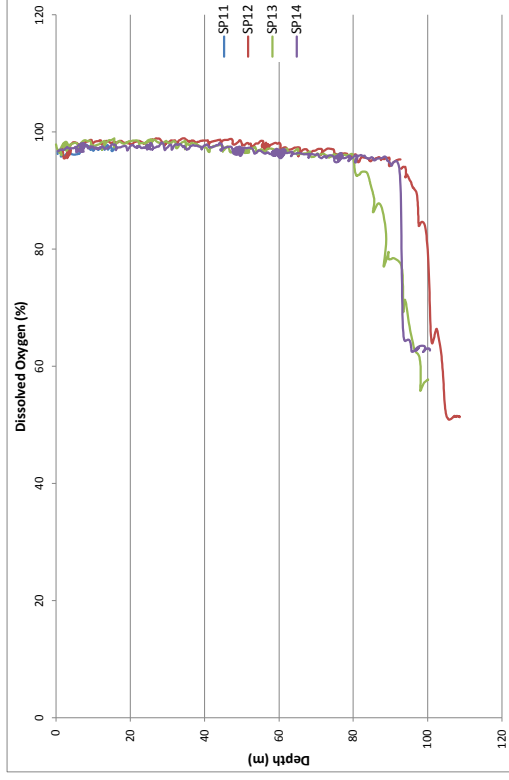
Although generally shallower than the permit area sites, dissolved oxygen at sites around Evans Shoal, Tassie Shoal and Lynedoch Bank exhibited a similar vertical distribution pattern according to the depth of the site (**Figure 3-3**). For example, dissolved oxygen at the shallowest (<30 m deep) sites, SP7, SP11 and SP16, did not change from surface water to bottom water. At the remaining sites, trends in dissolved oxygen profiles were similar to those at the permit area, with a layer of relatively constant dissolved oxygen in surface waters (approximately 60 m) followed by a rapid decline from 100% to 50% over approximately 40 m, and then a further gradual decline to the seafloor.



a) Permit area

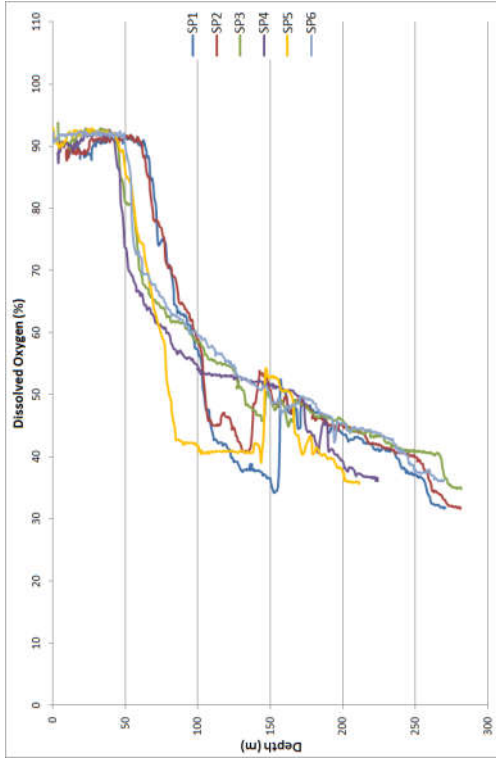


b) Evans Shoal

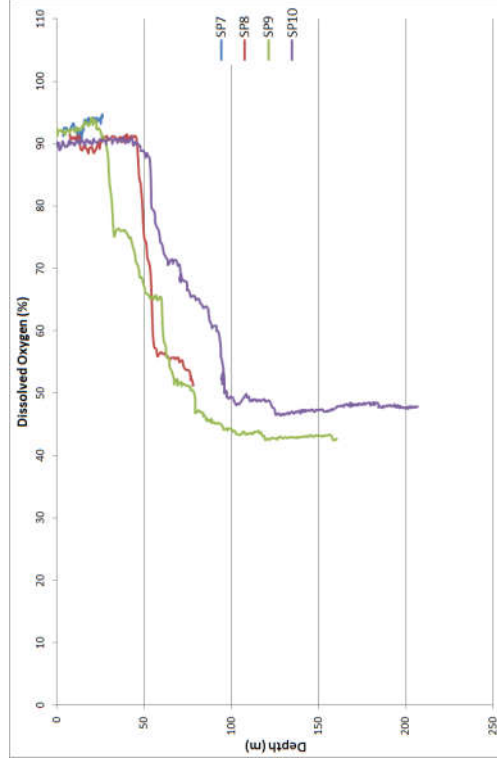


c) Tassie Shoal

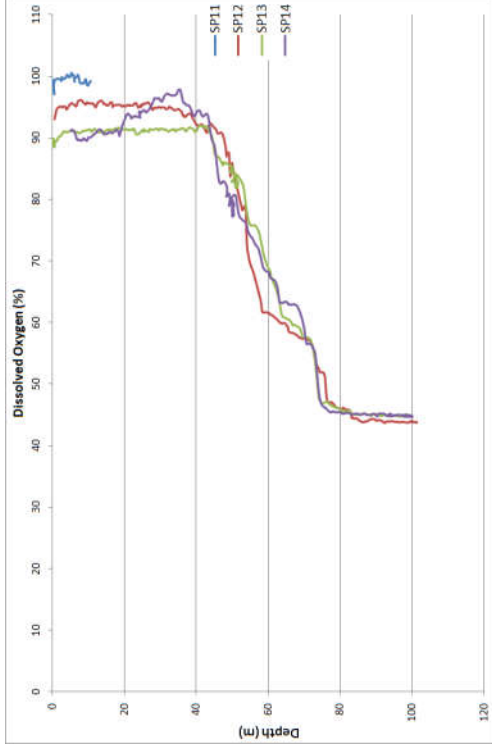
Figure 3-1: Dissolved oxygen profiles – winter



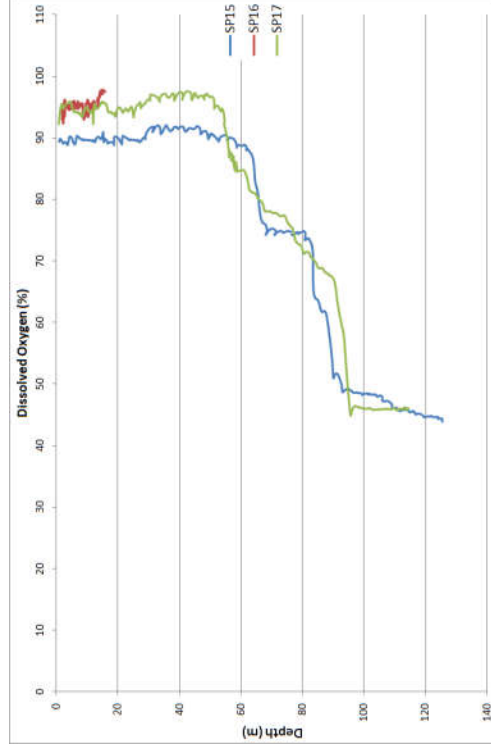
a) Permit area



b) Evans Shoal

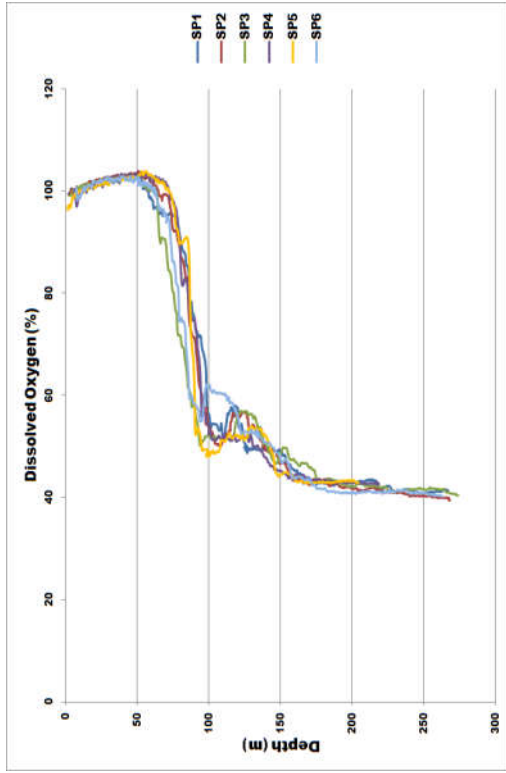


c) Tassie Shoal

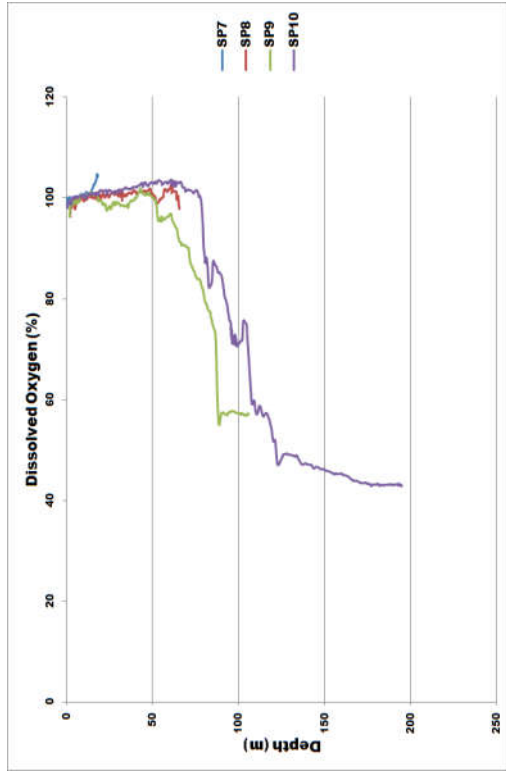


d) Lynedoch Bank

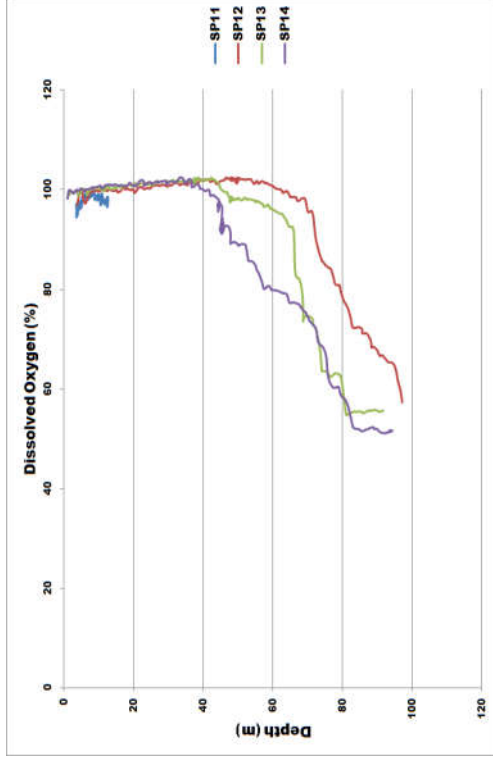
Figure 3-2: Dissolved oxygen profiles – summer



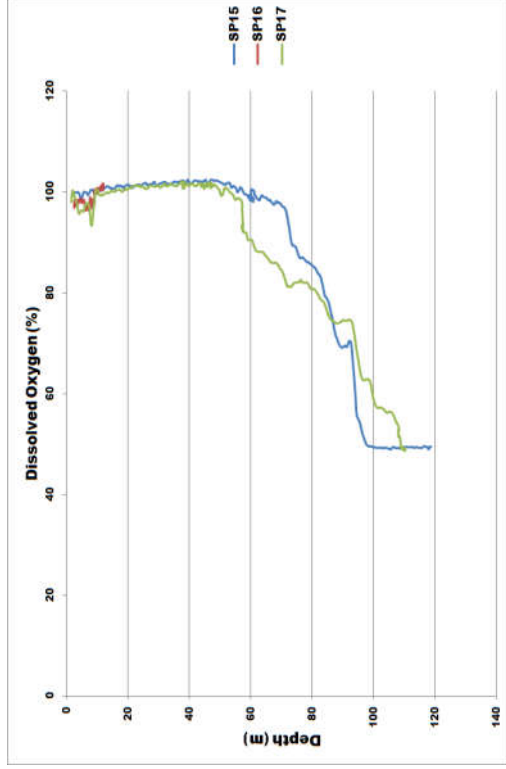
a) Permit area



b) Evans Shoal



c) Tassie Shoal



d) Lynedoch Bank

Figure 3-3: Dissolved oxygen profiles – autumn

3.1.3 Salinity

Winter

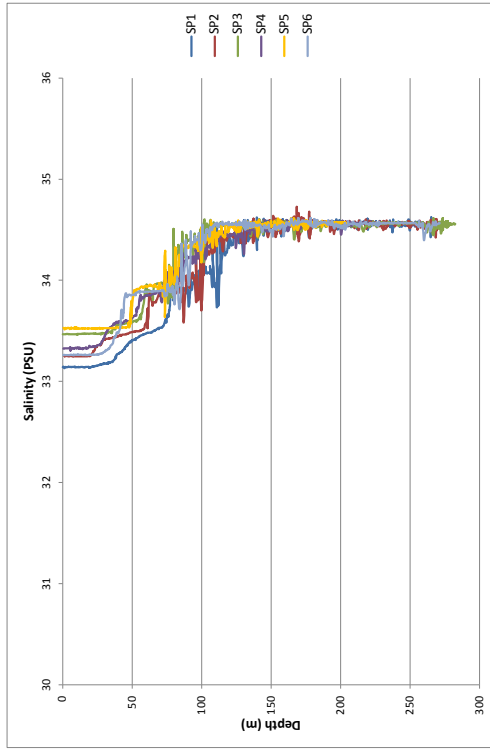
The vertical distributions of the salinity profiles of the various sites from within and around the permit area, Evans Shoal and Tassie Shoal (**Figure 3-4**) were similar depending on the depth of the individual site. Generally, the salinity was stable from the surface to the first 20 to 50 m, with a stepwise increase in salinity to approximately 75 m. After 75 m the salinity was quite erratic until 100 to 120 m then was stable to the seabed. The salinity at the surface ranged from 33.1 to 33.8 PSU depending on the site, which increased to approximately 34.5 PSU at the deepest sites.

Summer

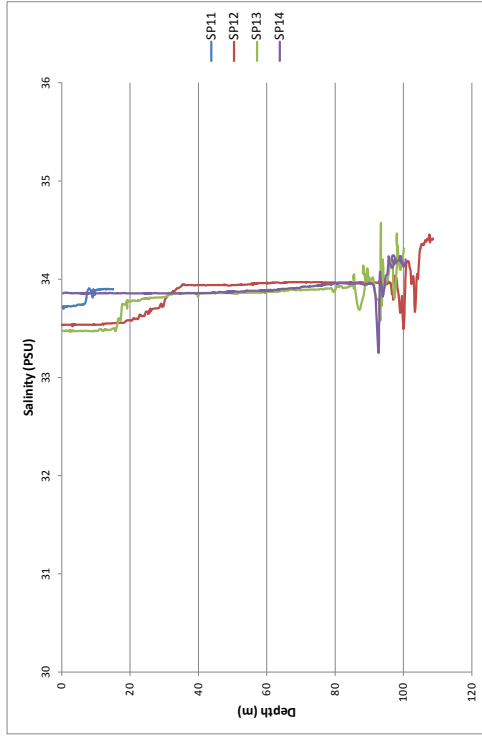
The vertical salinity profiles of the various sites within and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank (**Figure 3-5**) were similar and did not change markedly with depth. Generally, salinity was stable at approximately 34.0 PSU from the surface to 50 m depth and then increased slightly to the seabed. The change in salinity from surface to bottom was minor and depended on the depth of the site. At the shallowest sites (<30 m deep), there was no change in salinity from surface water to bottom water. At the mid-depth sites (approximately 100 m deep) salinity increased by approximately 0.2 PSU from surface to bottom. At the deepest sites (>200 m deep), there was an increase of 0.4 PSU from surface to bottom.

Autumn

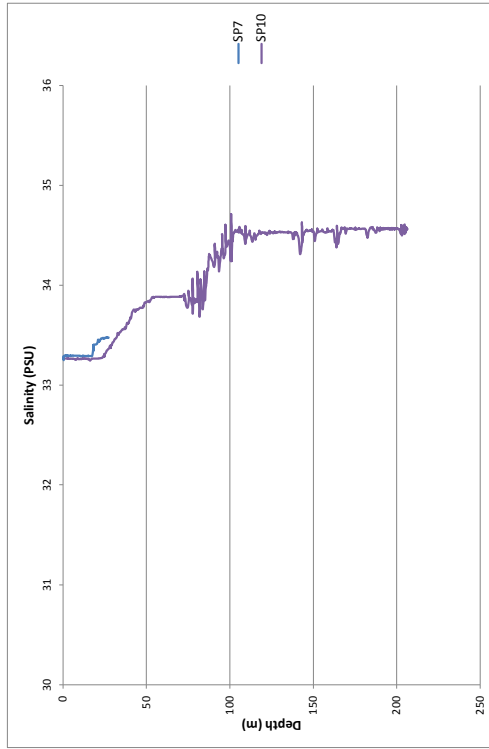
The vertical salinity profiles of the various sites within and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank (**Figure 3-6**) were similar and did not change markedly from surface to bottom. Generally, salinity was stable at approximately 34.0 PSU from the surface to approximately 60 m depth and then increased slightly to the seabed. The change in salinity from surface to bottom was minor and depended on the depth of the site. At the shallowest sites (<30 m depth), there was no change in salinity from surface water to bottom water. At the mid-depth sites (approximately 100 m depth), salinity increased by approximately 0.3 PSU. At the deepest sites (>200 m), there was an increase of 0.6 PSU from surface to bottom.



a) Permit area

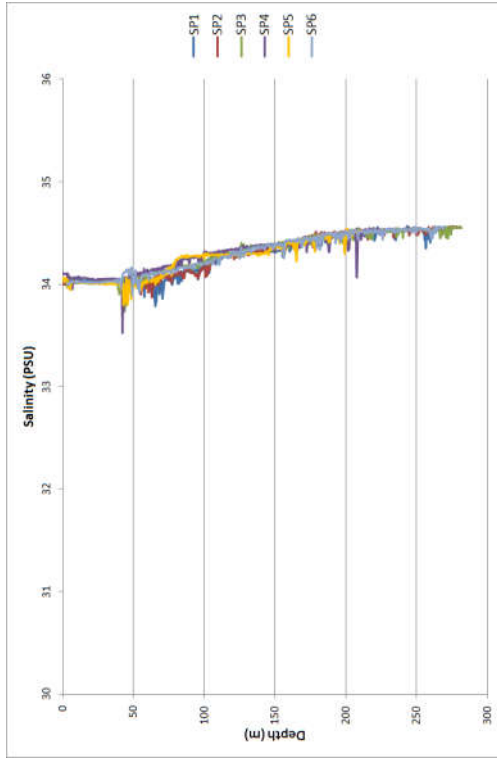


c) Tassie Shoal

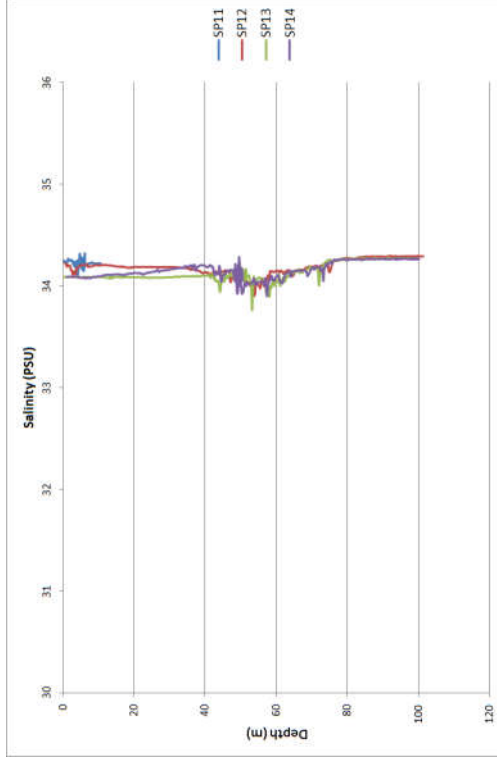


b) Evans Shoal

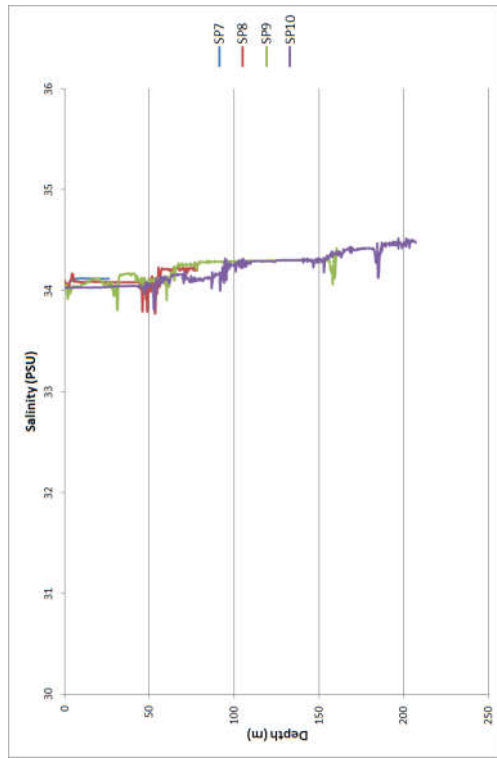
Figure 3-4: Salinity profiles – winter



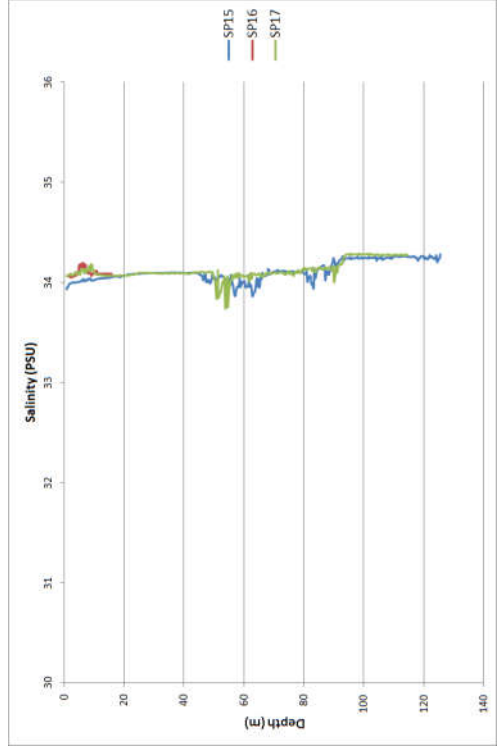
a) Permit area



c) Tassie Shoal

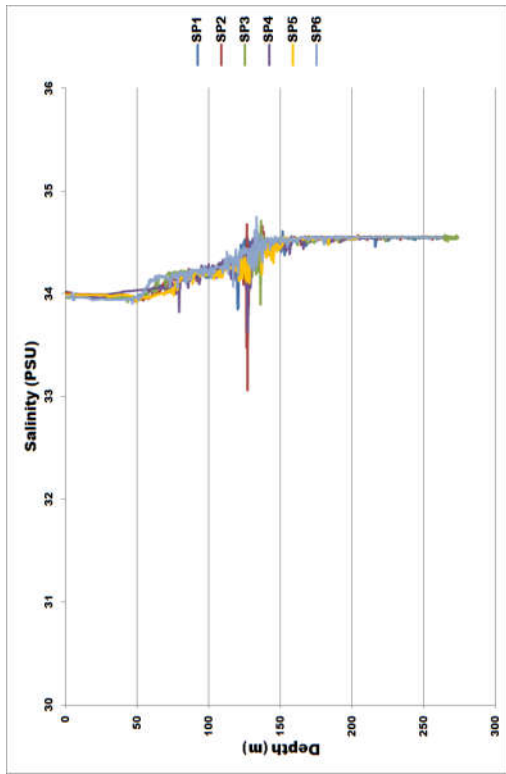


b) Evans Shoal

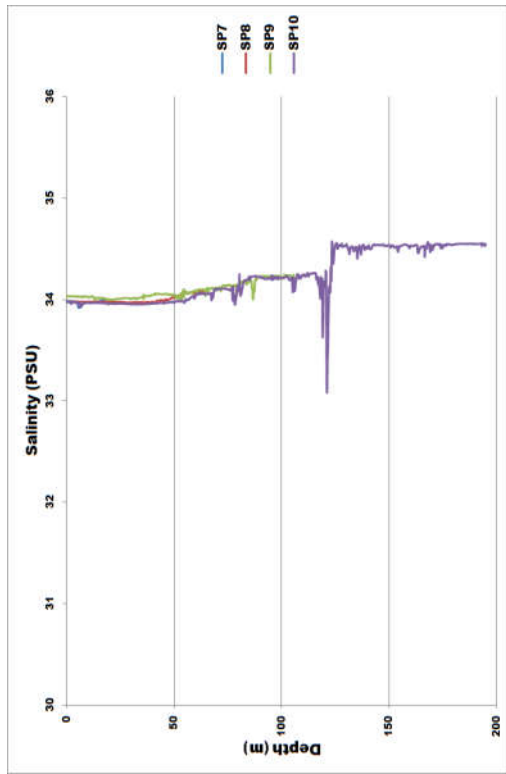


d) Lynedoch Bank

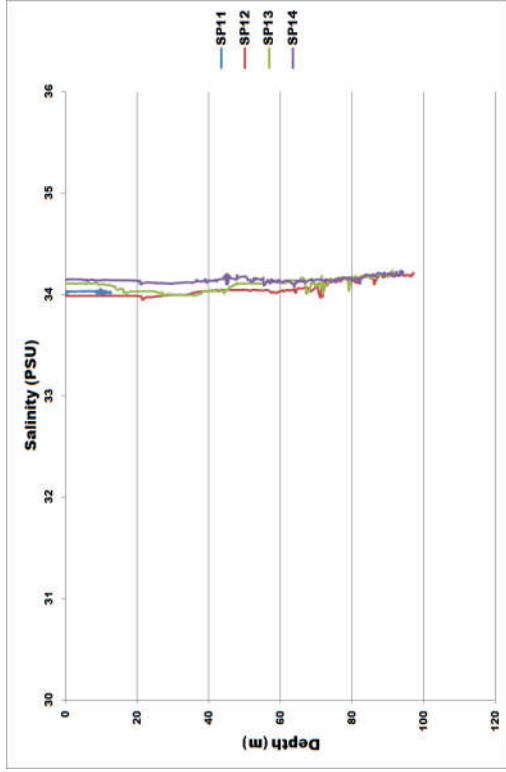
Figure 3-5: Salinity profiles – summer



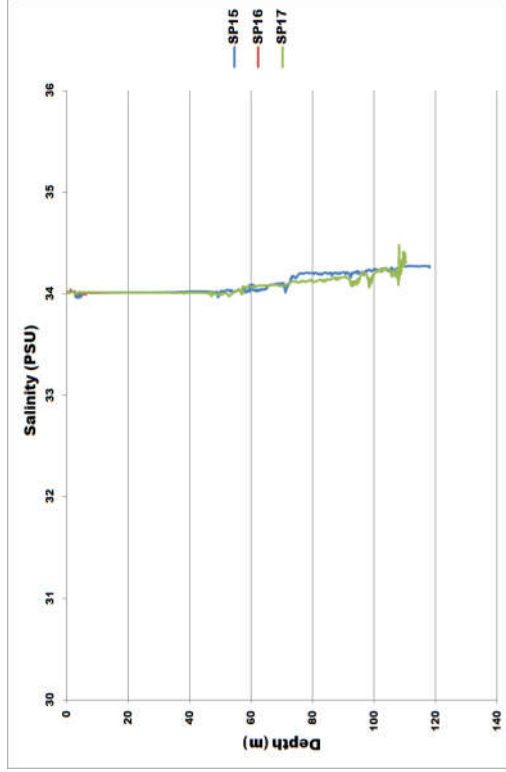
a) Permit area



b) Evans Shoal



c) Tassie Shoal



d) Lynedoch Bank

Figure 3-6: Salinity profiles – autumn

3.1.4 Water temperature

Winter

Temperature in the surface water at each of the sites in and near the permit area (**Figure 3-7**) were generally at 27°C which stayed constant through the water column until approximately 50 m, at that point there was a slight increase in temperature to approximately 27.8°C for approximately 20 m, then there was a rapid decline in temperature to approximately 17°C at 150 m. The temperature continued to decline steadily to approximately 11°C at the bottom of deepest sites.

The vertical profiles of the Evans Shoal and Tassie Shoal sites (**Figure 3-7**) were similar to the permit area sites, depending on the depth of the sample site. For example, the shallow sites SP7 and SP11 changed very little from surface to bottom, the temperature of the sites at 100 m depth (SP12, SP13 and SP14) increased slightly in the first 30 m then remained constant to 80 m from which there was a rapid decline in temperature to the bottom water. The thermocline is considered to lie in the zone in which the greatest temperature decrease occurs; in this case it occurred between approximately 70 m and 150 m. The zone above the thermocline is called 'the mixed zone' and the zone below it 'the deep zone'.

Summer

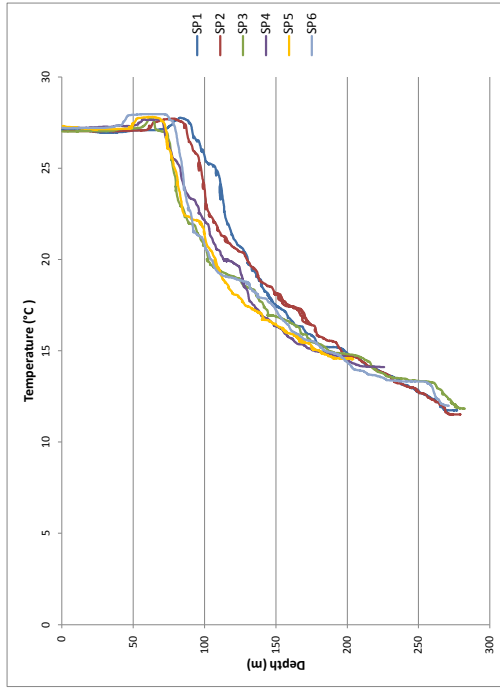
Water temperature in the surface layer at sites in and near the permit area (**Figure 3-8**) was generally around 29°C and stayed constant through the water column until approximately 40 m depth at most sites and until 50 m depth at SP1 and SP2. There was a rapid decline in temperature to approximately 25°C at 50 m at most sites and at 70 m depth at SP1 and SP2. Water temperature gradually declined to approximately 13°C at the bottom of deepest sites.

The vertical profiles of the Evans Shoal sites, Tassie Shoal sites and Lynedoch Bank sites (**Figure 3-8**) were similar to those observed at the permit area sites, depending on the depth of the site. For example, the shallow sites SP7, SP11 and SP16 changed very little from surface to bottom. The sites that were around 100 m deep (namely SP8, SP9, SP12, SP13, SP14, SP15 and SP17) had constant water temperatures of 29°C in the upper 50 m of water, which then decreased rapidly to 25°C in the next 20 m of water and then gradually declined to the bottom water. The thermocline is considered to lie in the zone in which the greatest temperature decrease occurs; in this case it occurred between approximately 40 m and 70 m.

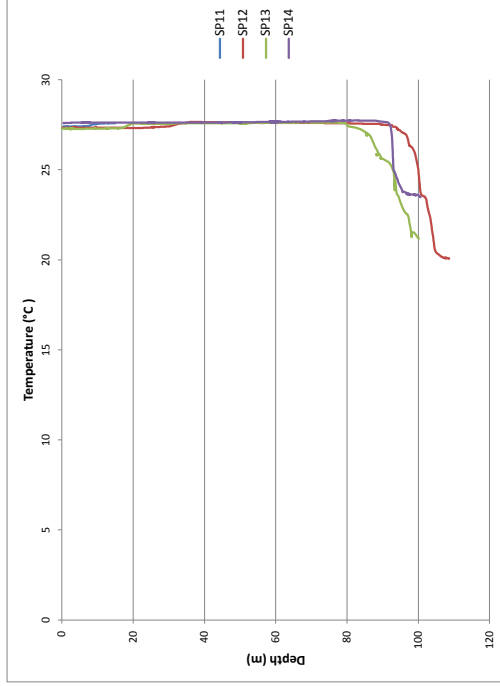
Autumn

Water temperature in the surface layer at sites in and near the permit area (**Figure 3-9**) was generally around 30°C and stayed constant through the water column until a depth of approximately 50 m. Temperature declined to approximately 25°C at approximately 110 m, rapidly declined to approximately 16°C at 140 m and gradually declined to approximately 12°C at the bottom of deepest sites.

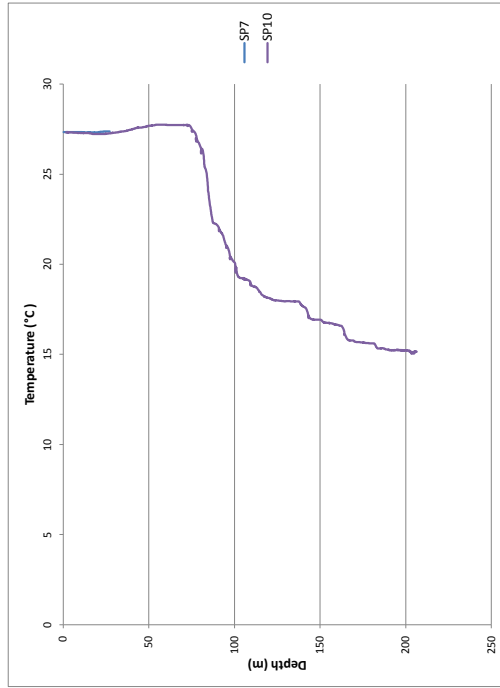
The vertical profiles of Evans Shoal, Tassie Shoal and Lynedoch Bank sites (**Figure 3-9**) were similar to those observed at the permit area sites, depending on the depth of the site. For example, the temperature of the shallow sites SP7, SP11 and SP16 changed very little from surface to bottom. The sites that were around 100 m deep (namely SP8, SP9, SP12, SP13, SP14, SP15 and SP17) had constant water temperatures of 30°C in the upper 50 m of water, declining to approximately 25°C in the bottom water. The thermocline is considered to lie in the zone in which the greatest temperature decrease occurs; in this case it occurred between 100 m and 150 m.



a) Permit area

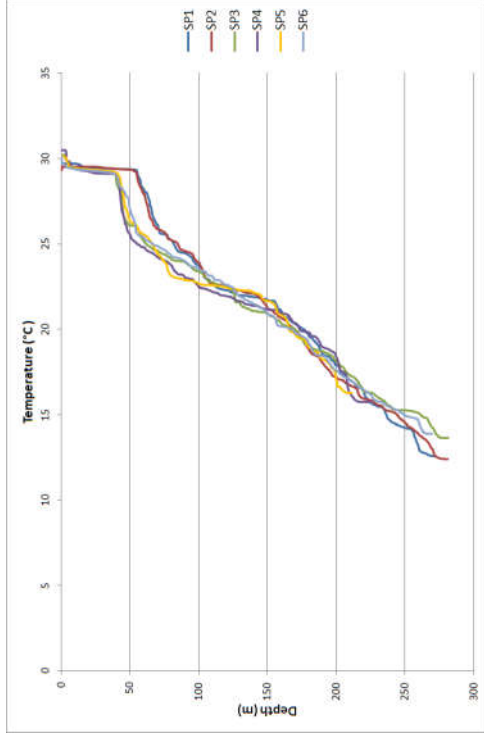


c) Tassie Shoal

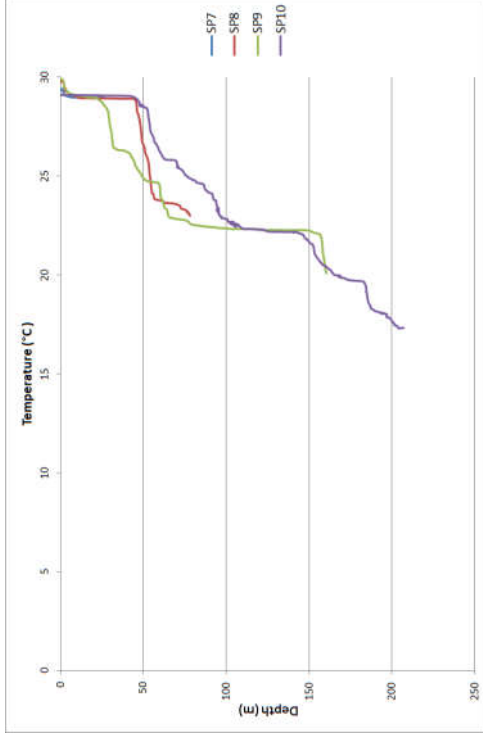


b) Evans Shoal

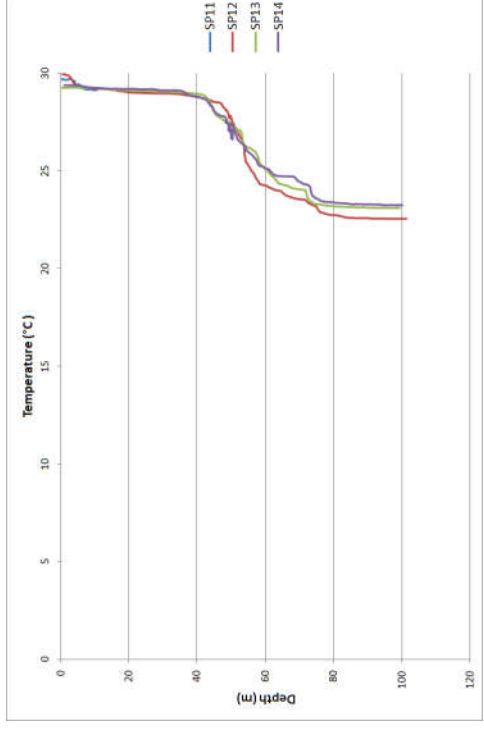
Figure 3-7: Temperature profiles – winter



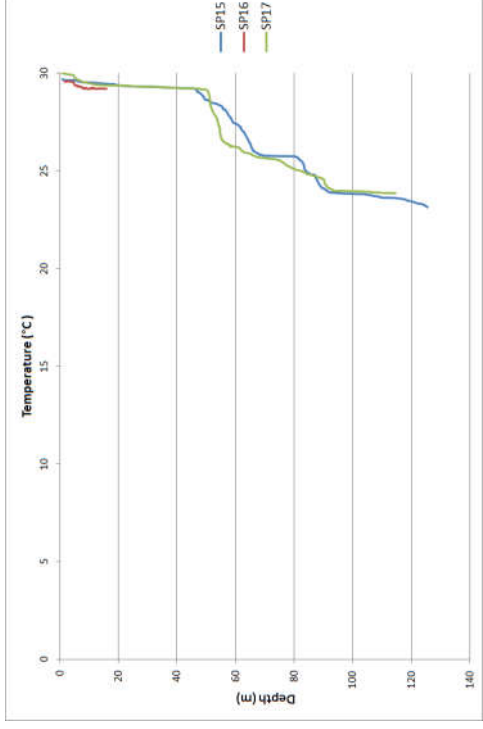
a) Permit area



b) Evans Shoal

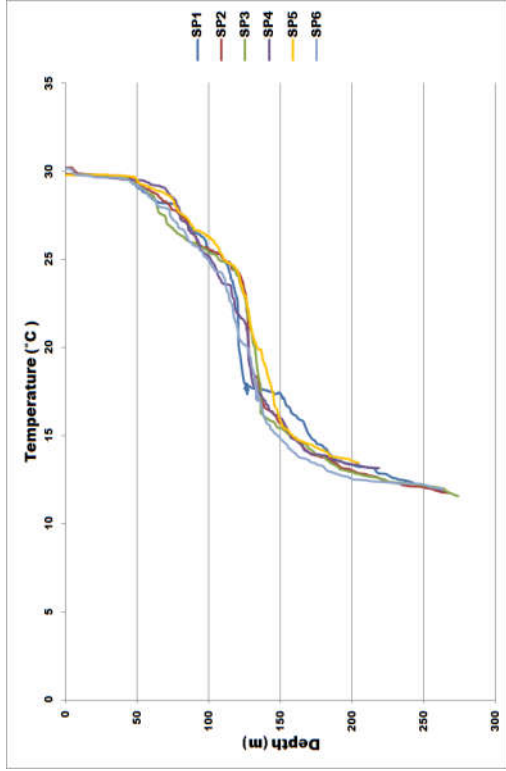


c) Tassie Shoal

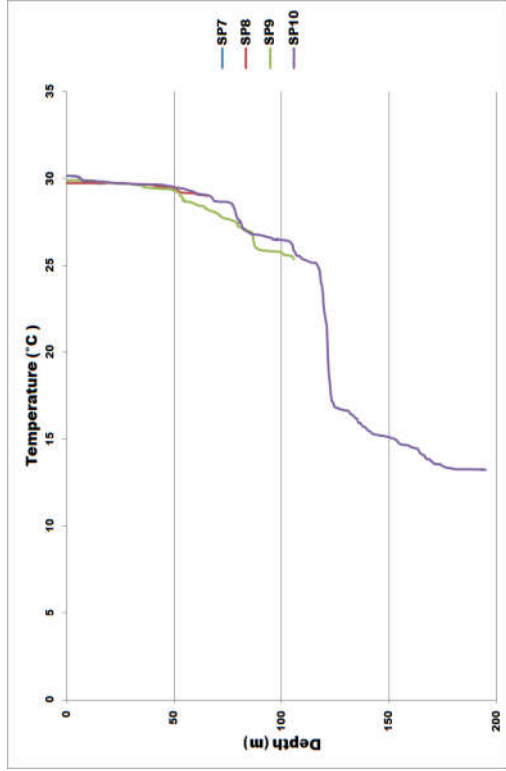


d) Lynedoch Bank

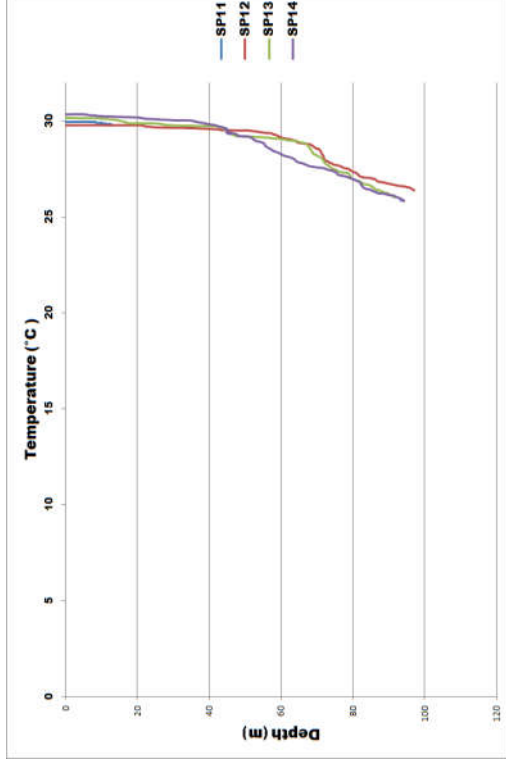
Figure 3-8: Temperature profiles – summer



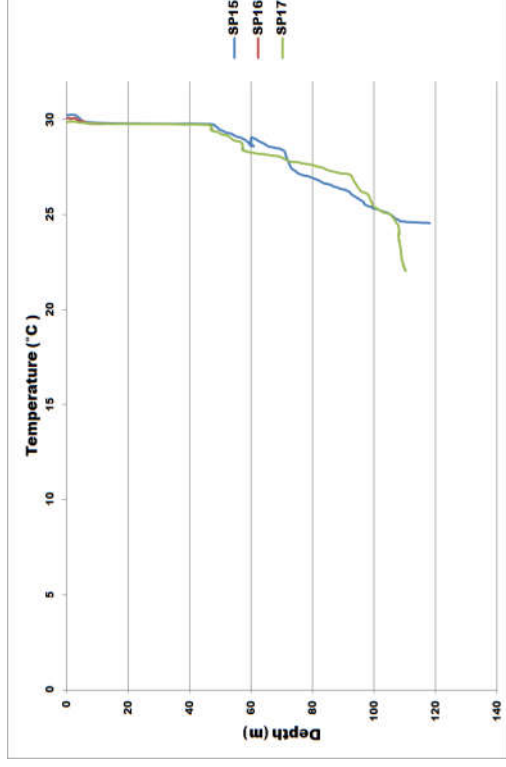
a) Permit area



b) Evans Shoal



c) Tassie Shoal



d) Lynedoch Bank

Figure 3-9: Temperature profiles – autumn

3.1.5 Turbidity

Winter

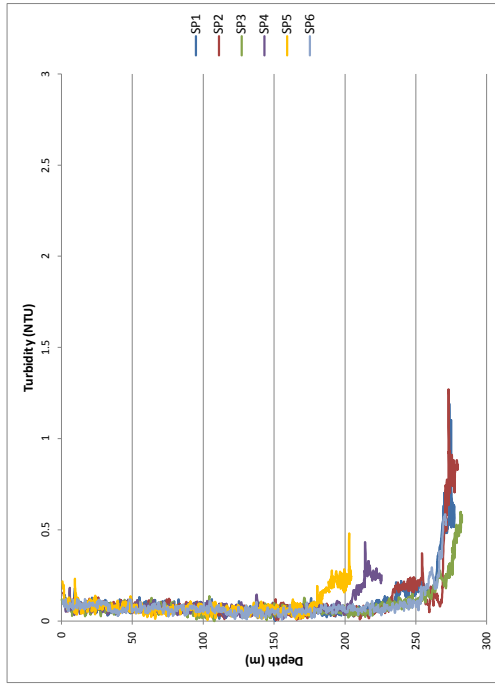
The turbidity of the water at sites in and around the permit area, Evans Shoal and Tassie Shoal were very low (<1.3 NTU) at all sites from the surface to near the seabed (**Figure 3-10**). It was constant at < 0.1 NTU from the surface to approximately 20–50 m from the bottom, at that point the turbidity increased towards the seabed; however, the increase was only minor. The exception was the shallow sites which remained similar from surface to bottom. Site SP10 had very slight increase in turbidity at 80 m.

Summer

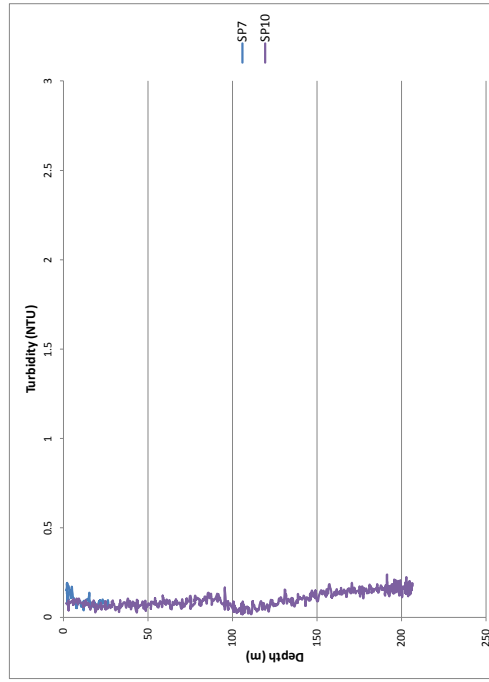
Turbidity at all sites in and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank was very low (<2 NTU) from the surface to near the seabed (**Figure 3-11**). At most sites, turbidity was constant at <0.1 NTU from the surface to approximately 20–50 m above the seabed, at which point the turbidity increased slightly to the bottom. The exception was at shallow sites whereby turbidity remained similar throughout the water column. Sites SP1, SP2 and SP5 had very slight increases in turbidity between 80 m and 156 m.

Autumn

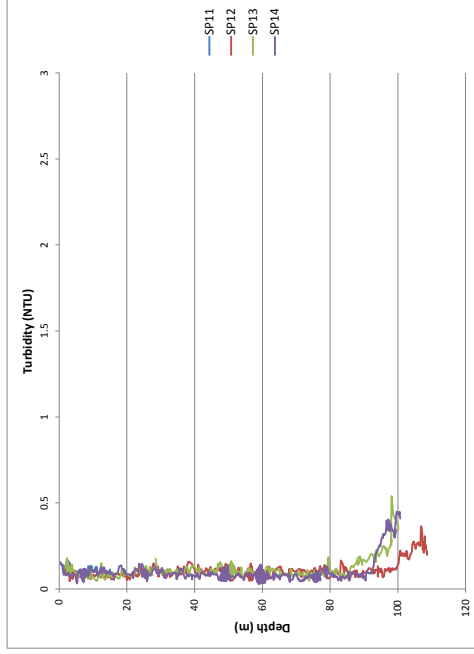
Turbidity at all sites in and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank were very low (<0.5 NTU) from the surface to near the seabed (**Figure 3-12**). At most sites, turbidity was constant at <0.1 NTU from the surface to approximately 20–50 m above the seabed, below which turbidity increased towards the seabed; however, this increase was slight. The exception was the shallow sites (≤ 25 m), where turbidity remained similar throughout the water column.



a) Permit area

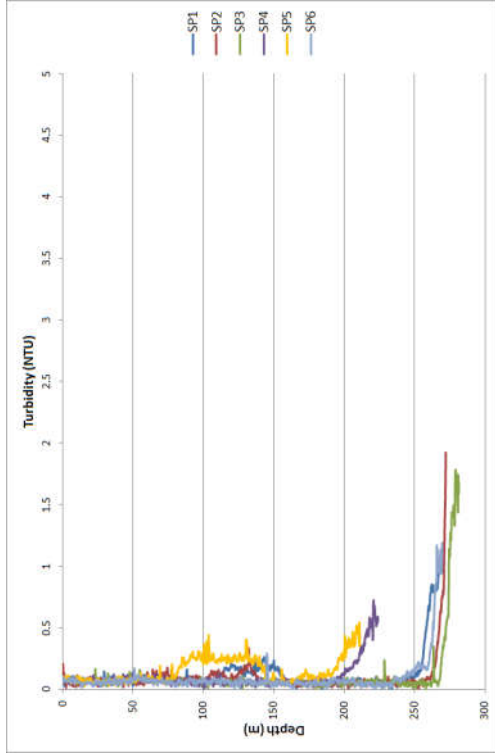


b) Evans Shoal

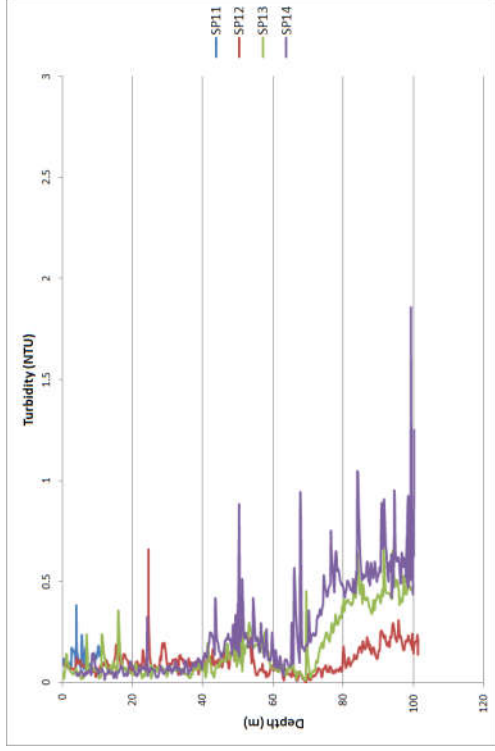


c) Tassie Shoal

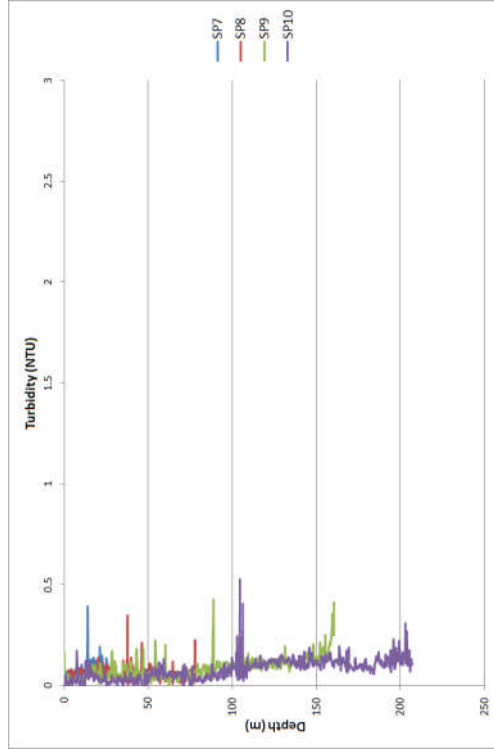
Figure 3-10: Turbidity profiles – winter



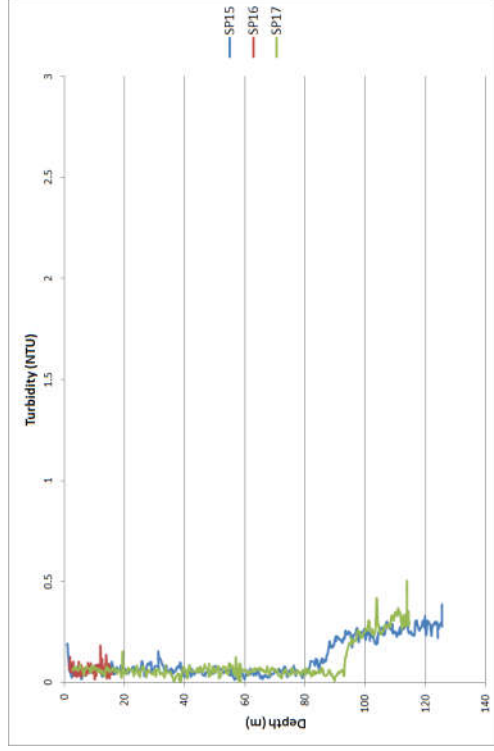
a) Permit area



c) Tassie Shoal

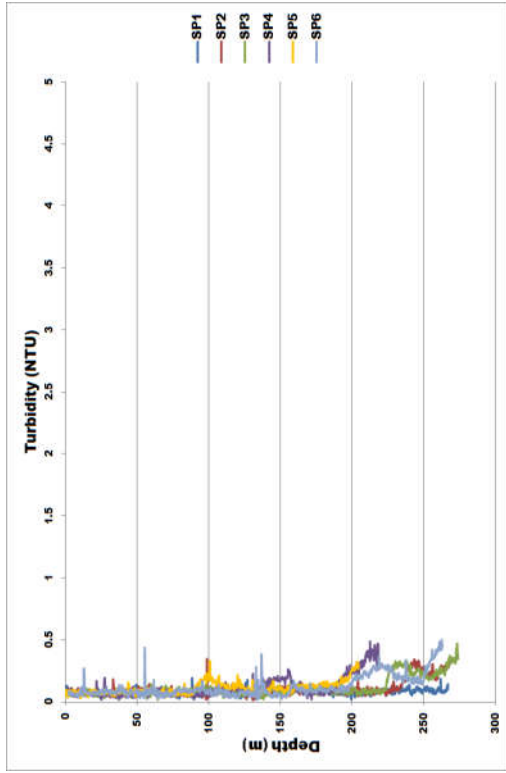


b) Evans Shoal

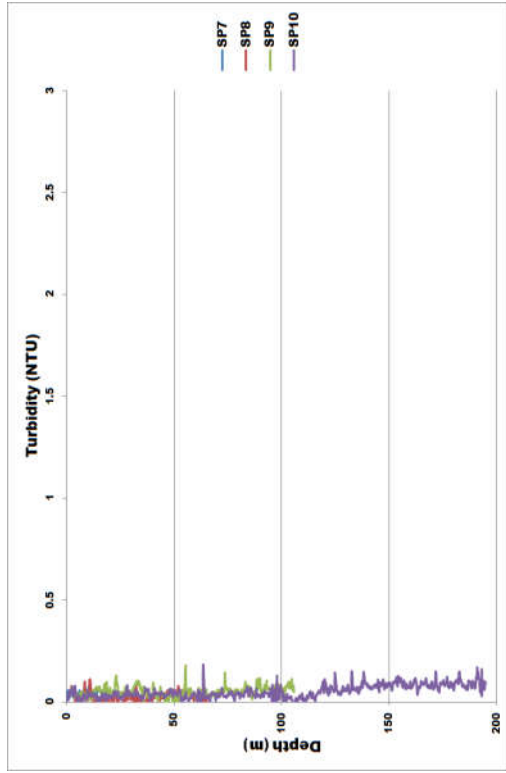


d) Lynedoch Bank

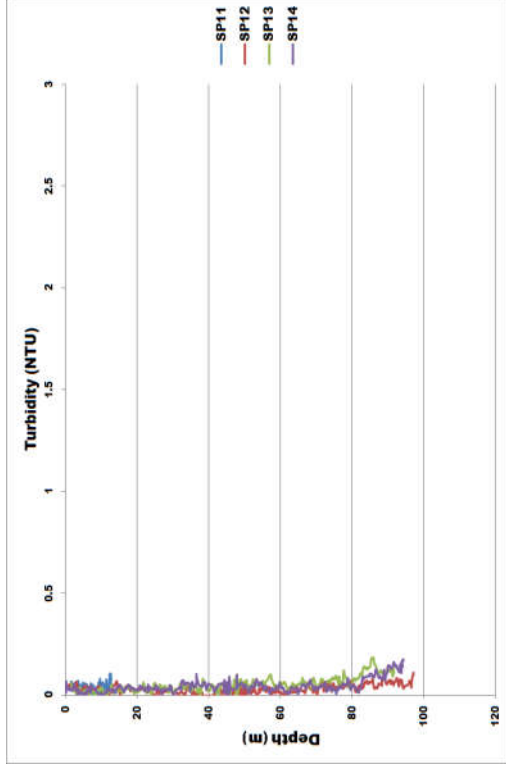
Figure 3-11: Turbidity profiles – summer



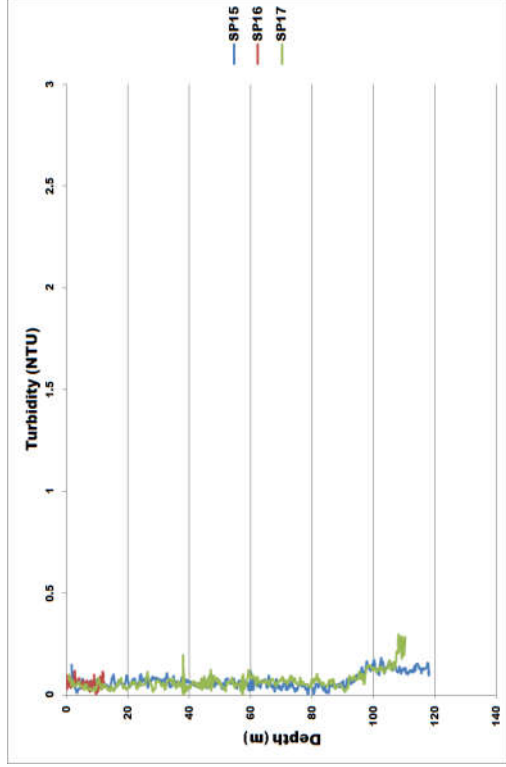
a) Permit area



b) Evans Shoal



c) Tassie Shoal



d) Lynedoch Bank

Figure 3-12: Turbidity profiles – autumn

3.1.6 TSS

Winter

TSS concentrations were below detection limit at the surface of the selected sites sampled during this survey (**Table 3-2**).

Summer

TSS concentrations were low (≤ 1 mg/L) at the water surface of all sites sampled during this survey, and below the laboratory detection limit at sites SP2 and SP6 (**Table 3-2**).

Autumn

No sampling of TSS was undertaken at any of the sites during the autumn survey.

Table 3-2: TSS in surface water at selected sites

Location	Sites	Turbidity (mg/L)	
		Winter	Summer
Permit area	SP2	<0.5	<0.5
	SP3	<0.5	0.8
	SP6	<0.5	<0.5
Evans Shoal	SP7	NS	0.7
Tassie Shoal	SP12	<0.5	0.8
Lynedoch Bank	SP16	NS	1.0

NS – no sample

3.1.7 pH

Winter

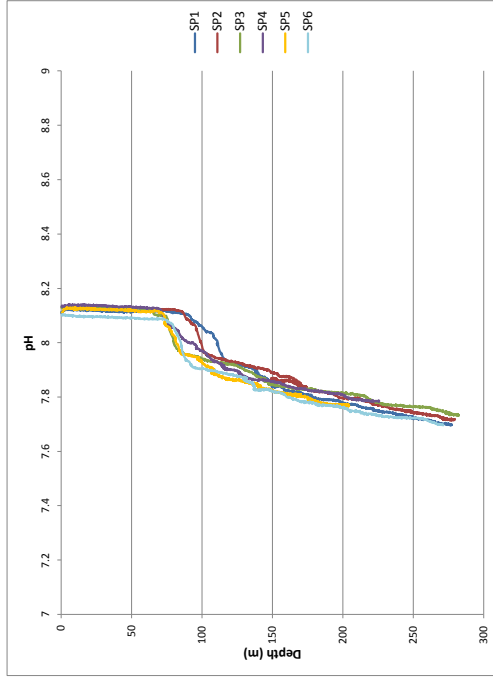
The pH of the surface water for each of the sites from in and around the permit area, Evans Shoal and Tassie Shoal (**Figure 3-13**) was approximately 8.1. The pH remained stable from the surface waters to approximately 80 m and then decreased rapidly to 7.9 at about 100 m of water depth. The pH decreased further to approximately 7.7 at the deepest sites.

Summer

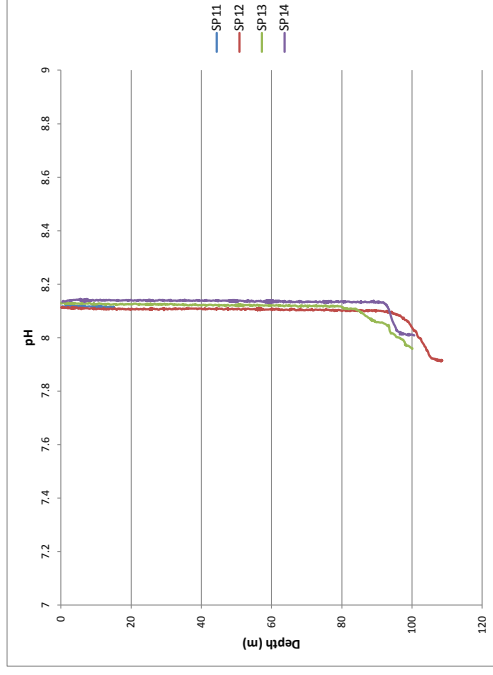
The pH of the surface water for sites within and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank (**Figure 3-14**) ranged from 8.15 to 8.25. The pH remained stable from the surface waters to ~50 m depth; there was a rapid decrease after this and then a more gradual decrease to the bottom water. The pH decreased to approximately 7.9 at the deepest sites. The shape of the individual pH profiles was similar to the dissolved oxygen profiles.

Autumn

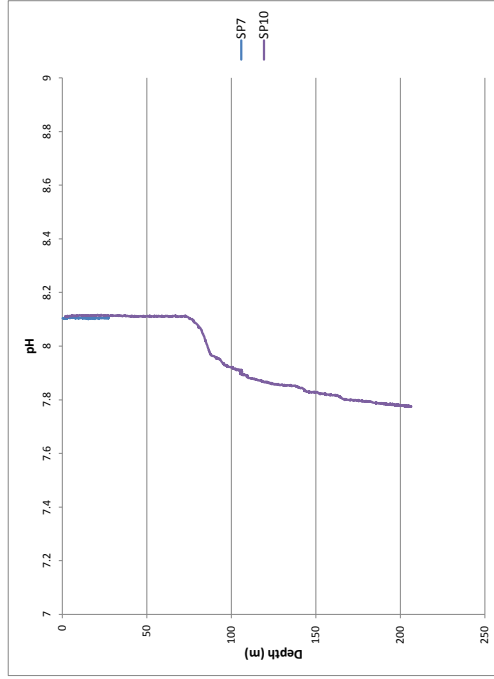
The pH of the surface water for sites within and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank (**Figure 3-15**) ranged from 8.19 to 8.31. The pH remained stable from the surface waters to approximately 60 m depth and then decreased rapidly to 8.0 at approximately 110 m deep, there was more gradual decrease to the seabed. The pH decreased to approximately 7.7 at the deepest sites (>200 m). The shape of the individual pH profiles was similar to that of the dissolved oxygen profiles.



a) Permit area

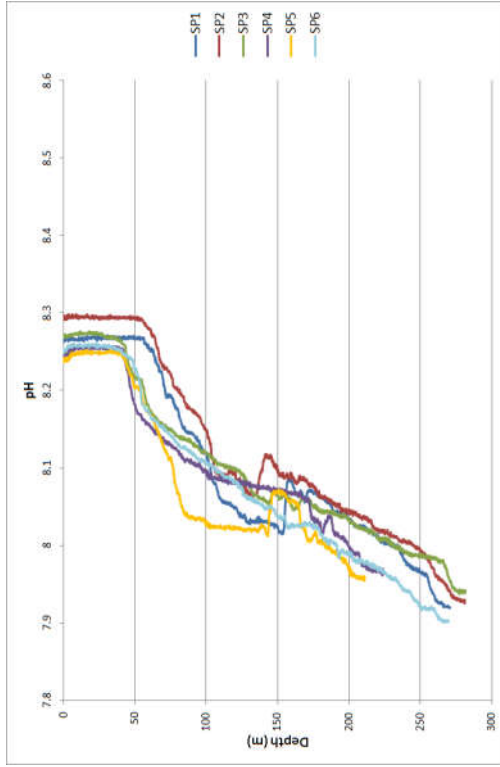


c) Tassie Shoal

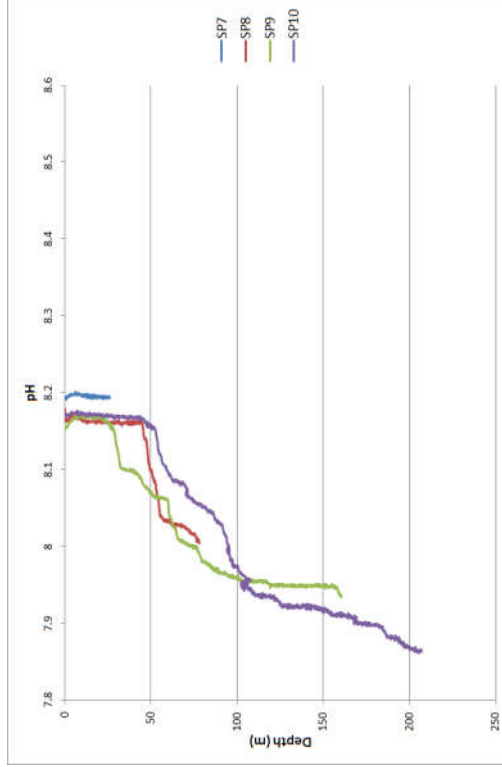


b) Evans Shoal

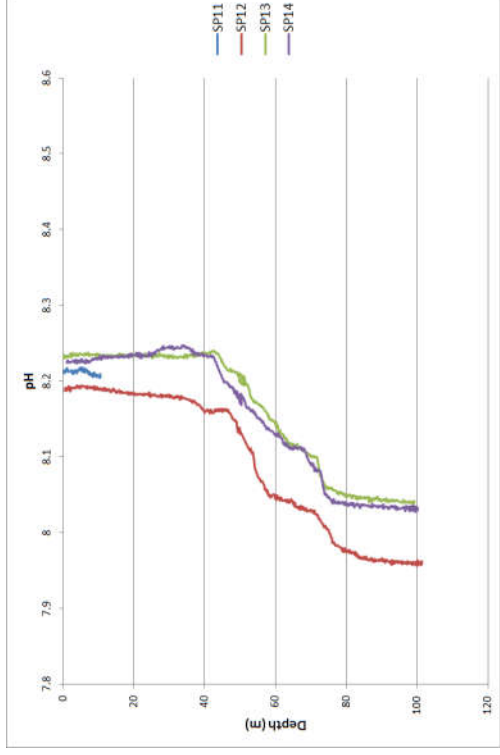
Figure 3-13: pH profiles – winter



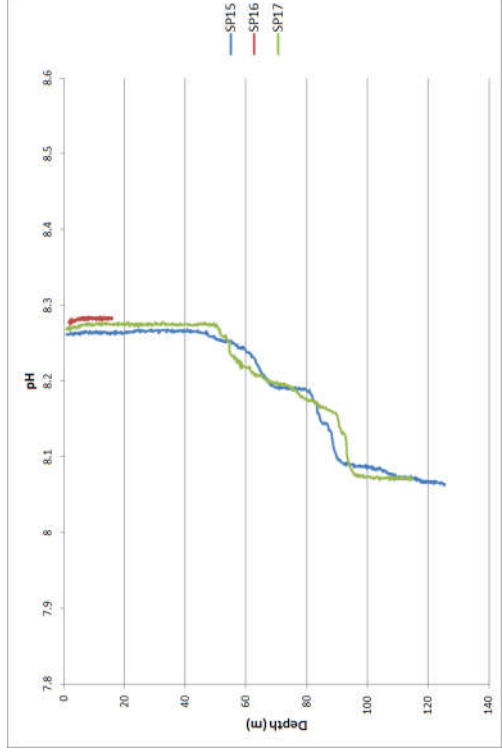
a) Permit area



b) Evans Shoal

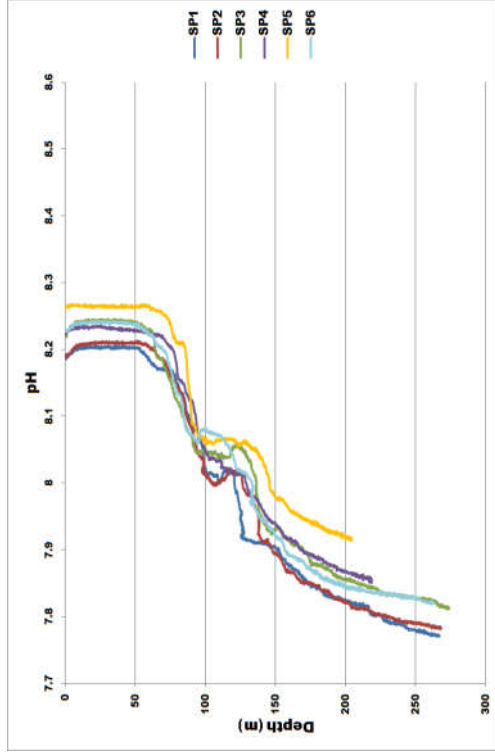


c) Tassie Shoal

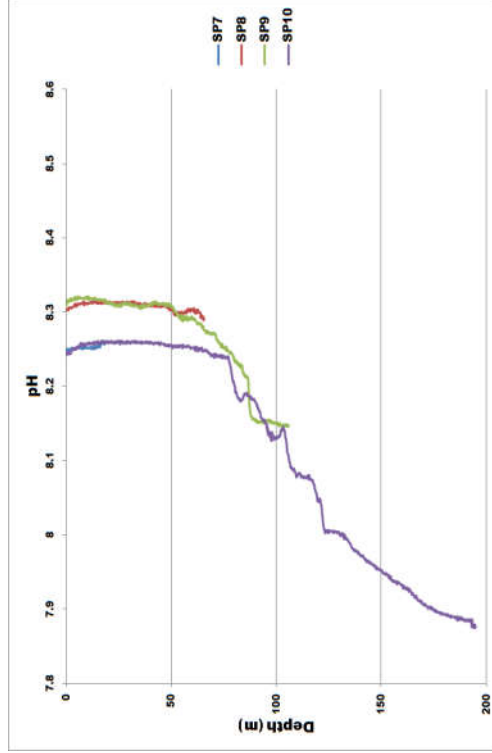


d) Lynedoch Bank

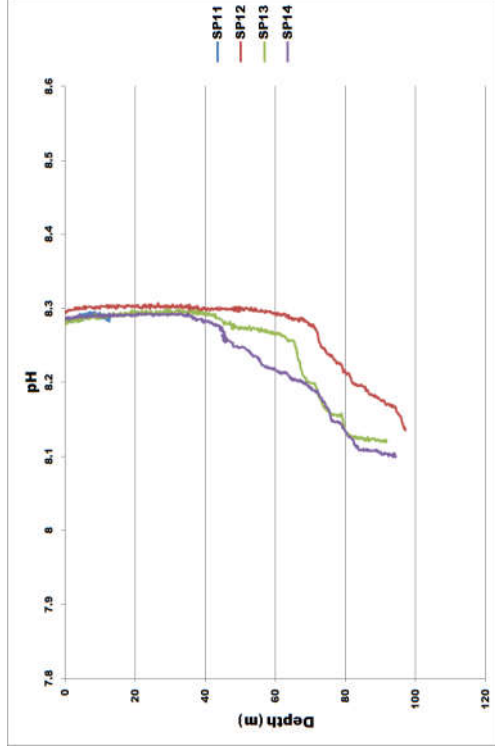
Figure 3-14: pH profiles – summer



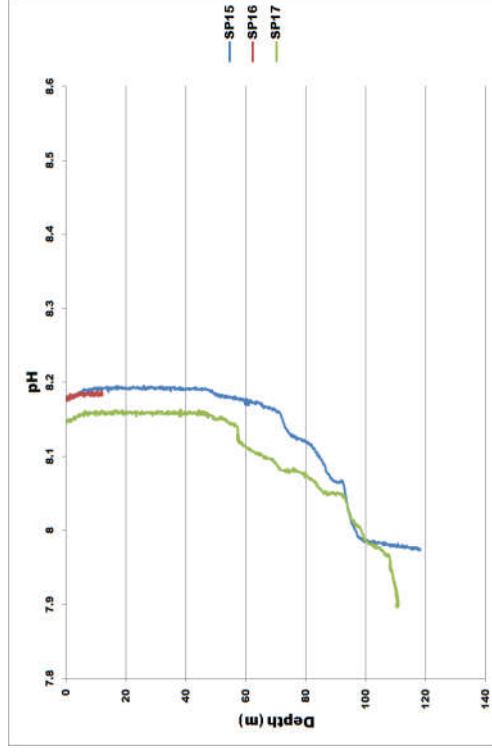
a) Permit area



b) Evans Shoal



c) Tassie Shoal



d) Lynedoch Bank

Figure 3-15: pH profiles – autumn

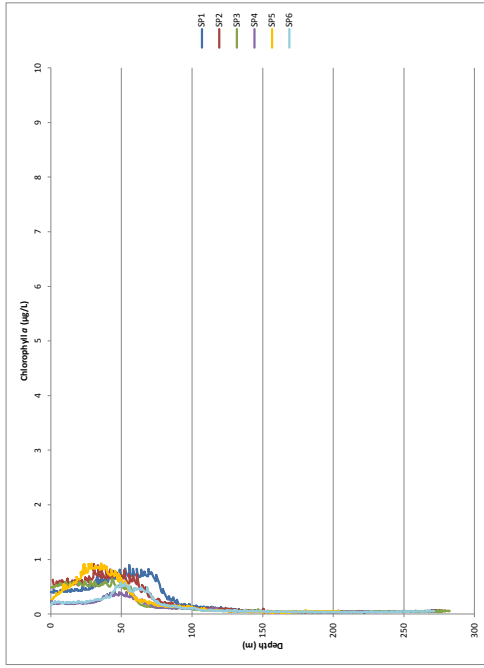
3.1.8 Chlorophyll *a*

Winter

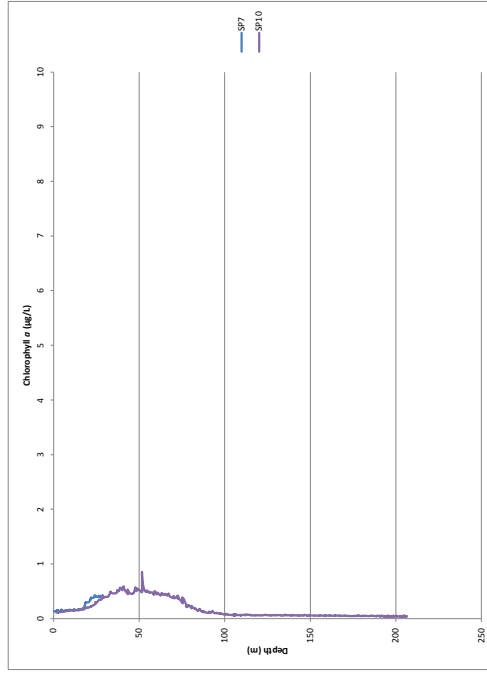
As expected, chlorophyll *a* was highest in the surface water compared with deeper water over 100 m, where the penetration of light would be minimal. The chlorophyll *a* concentrations were very low throughout the water column (<1 µg/L) and appeared to peak at different depths for the various sites in each area (**Figure 3-16**). The chlorophyll *a* concentration at SP5 increased from the surface water to approximately 30 m. For most of the other sites the highest concentration occurred at 50–60 m.

Autumn

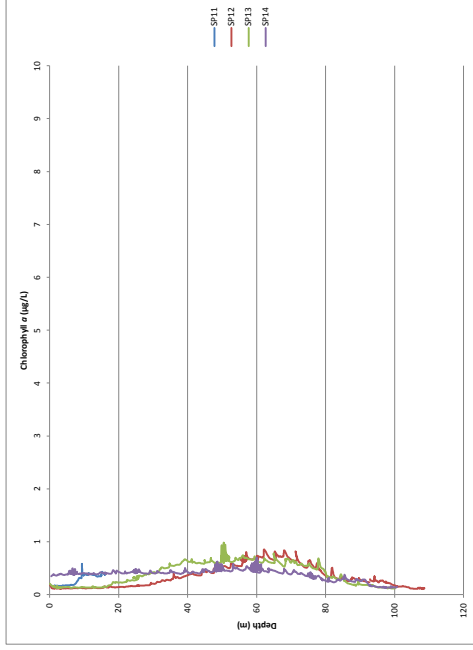
Chlorophyll *a* concentrations of the surface water for sites in and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank were <0.1 µg/L (**Figure 3-17**). Chlorophyll *a* concentrations generally peaked at approximately 70 m depth and decreased to <0.1 µg/L after 100 m depth, suggesting the euphotic zone reached a depth of approximately 70 m during this survey.



a) Permit area

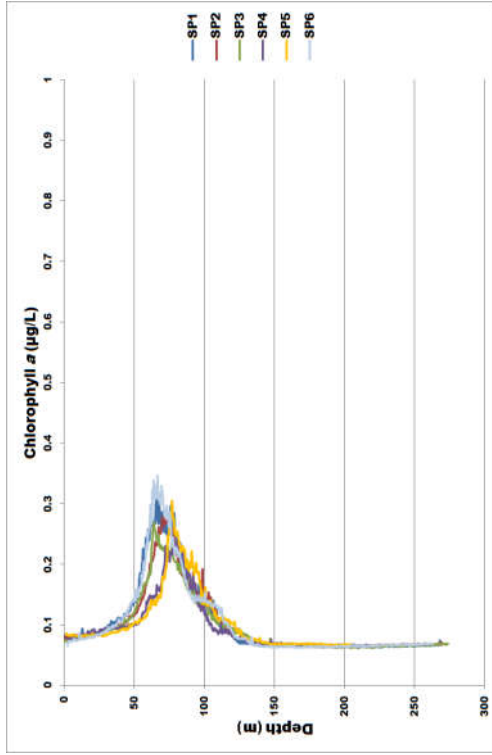


b) Evans Shoal

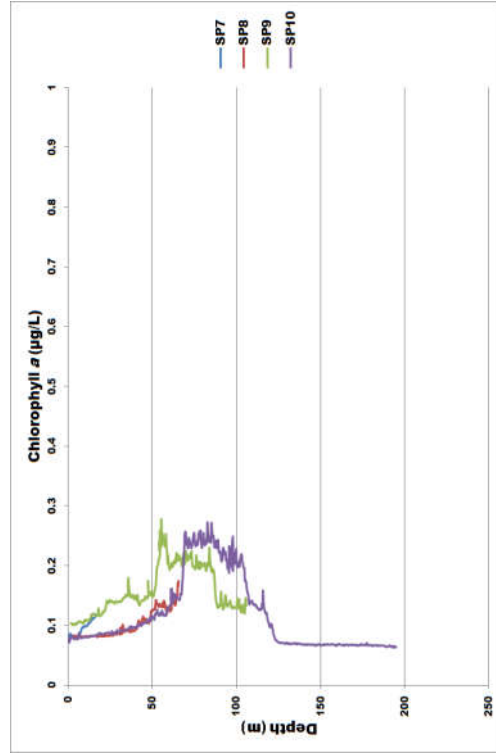


c) Tassie Shoal

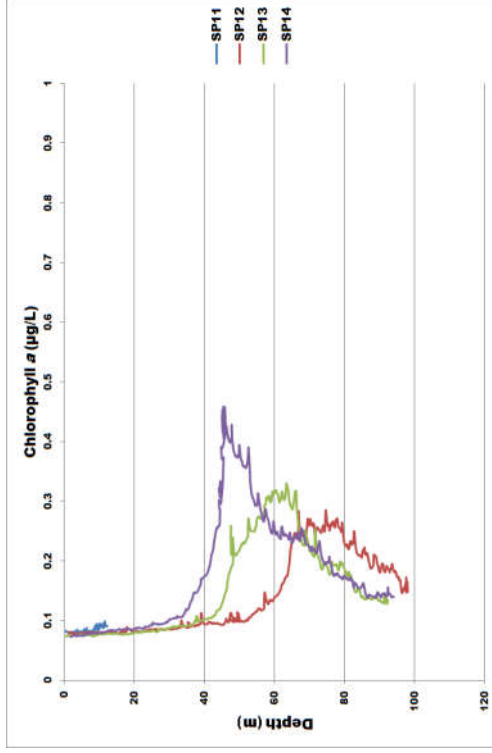
Figure 3-16: Chlorophyll a profile – winter



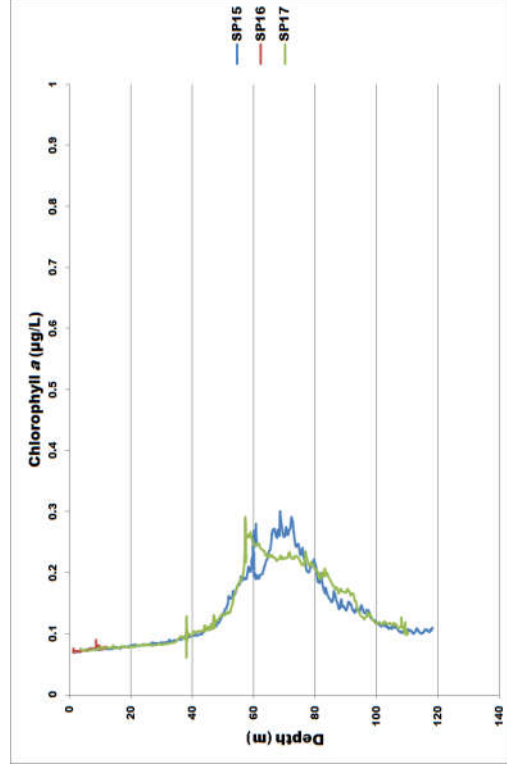
a) Permit area



b) Evans Shoal



c) Tassie Shoal



d) Lynedoch Bank

Figure 3-17: Chlorophyll *a* profile – autumn

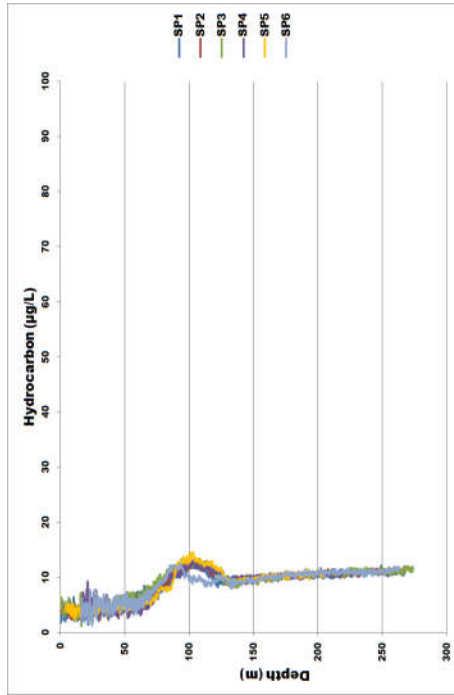
3.1.9 Hydrocarbons

The hydrocarbon profiles at all sites and for all seasons in and around the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank were similar for sites with similar depths therefore only the autumn graphs are shown (**Figure 3-18**). Generally, there was little difference in hydrocarbon readings between the top (4 µg/L) and bottom (11 µg/L) of the water column for any season. These slight differences are considered interferences on the hydrocarbon fluorescence sensor and it is unlikely that they represent changes in hydrocarbon concentrations with depth. At the surface, the sensor readings were very erratic due to high incident light levels interfering with the fluorescence readings. Hydrocarbon profiles also tend to show a reverse of dissolved oxygen profiles, albeit with a much smaller response. If oxygen molecules are present then the amount of fluorescing is reduced, referred to as fluorescence quenching. Therefore, while the oxygen is highest in the mixing zone, the fluorescence sensor had a slightly lower reading compared with deep water where dissolved oxygen is much lower.

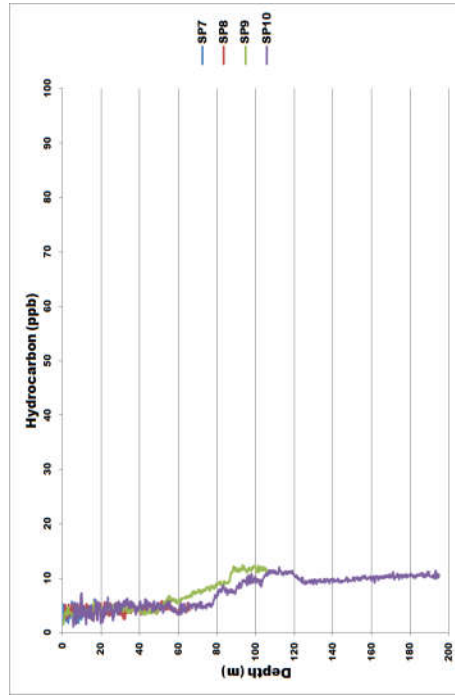
All sites for all seasons produced very similar profiles, without any spikes associated with hydrocarbon presence. It can therefore be concluded that there were no naturally occurring hydrocarbons present at any of the sites sampled during the surveys.

Verification of specific hydrocarbons in seawater can only be completed once laboratory results are available for hydrocarbon samples from the surface, middle and bottom water from each site. If results showed high and low hydrocarbon readings, a correlation coefficient could be calculated to convert the equivalent quinine sulfate concentrations (used to calibrate the sensor) into specific hydrocarbon concentrations. However, all the hydrocarbon readings from the laboratory were below the laboratory detection limit of 20 µg/L (**Section 3.2.3**) so a correlation coefficient could not be calculated.

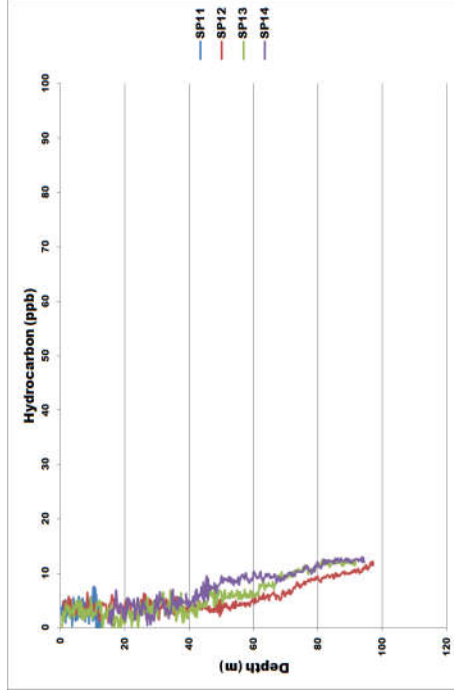
For comparative purposes, a test was conducted in the Darwin Harbour (winter) to provide an example of the readings that would be expected to occur if hydrocarbons were present. The results are presented in **Figure 3-19**.



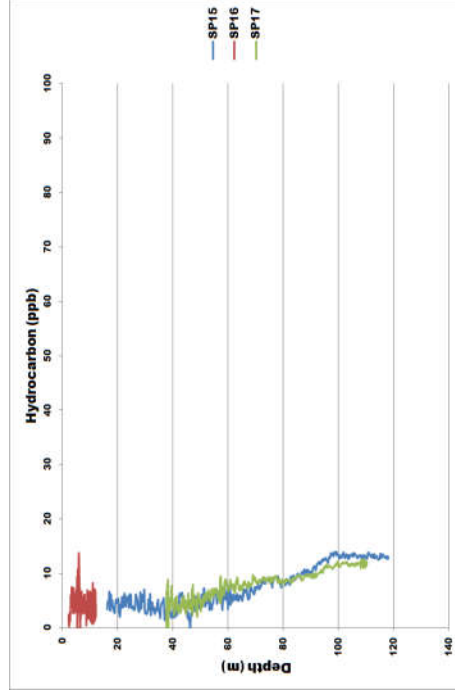
a) Permit area



b) Evans Shoal



c) Tassie Shoal



d) Lynedoch Bank

Figure 3-18: Hydrocarbon profiles – autumn

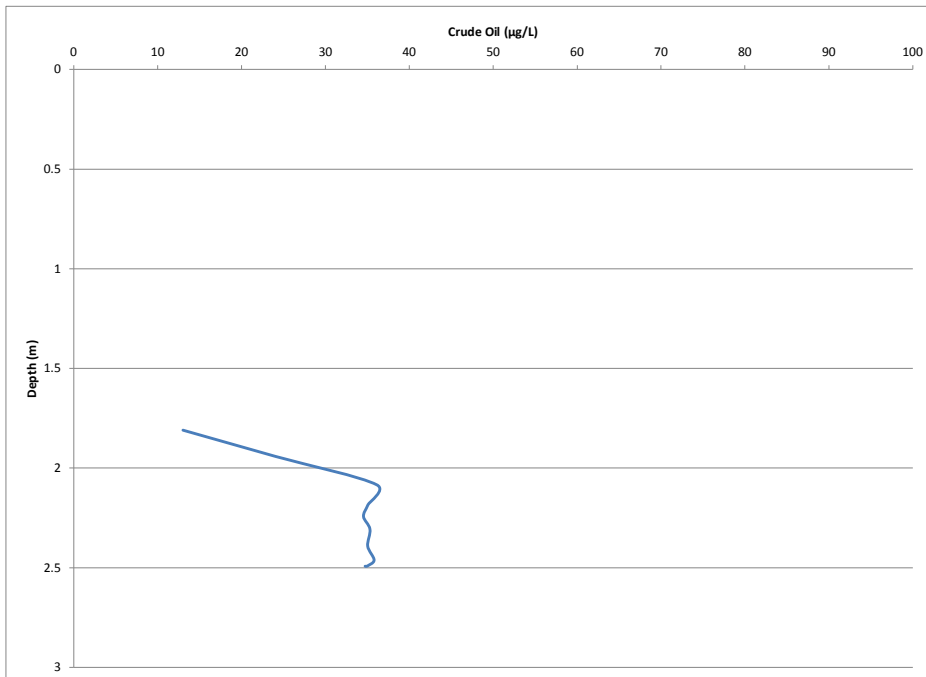


Figure 3-19: Hydrocarbon profile in Darwin Harbour (winter)

3.2 Water quality

3.2.1 Nutrients and pigments

The ANZECC & ARMCANZ (2000b) default trigger values for chemical stressors for tropical Australia for slightly disturbed offshore marine ecosystems are listed in **Table 3-3** to Table 3-6. The nutrient concentrations measured in samples from the shallow depths at each of the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sites were around the default trigger values, but most of the samples from deeper waters had nutrient concentrations that were well above the default trigger values (with the exception of ammonium concentrations which were at or below the laboratory LOR at most sites and depths).

Nitrogen

Total nitrogen is comprised of ammonium, nitrate+nitrite and organic nitrogen. At most sites there was no detectable ammonium at any depth (**Table 3-3** to Table 3-6). Nitrate+nitrite concentrations were lowest in the surface water at all sites. All results indicate increasing nitrate+nitrite concentrations with depth. In general, nitrogen concentrations in the surface layers were low and mainly comprised of organic nitrogen while the bottom layers were higher and mainly comprised of nitrate+nitrite.

The sites where total nitrogen ammonium and nitrate+nitrite were detected during each sampling event and any trends in the surveys are discussed below.

Winter

The majority of the results from the winter survey did not detect ammonium at any depth with the exceptions of sites SP2-S, SP7-B, SP11-B and SP14 (all depths). These higher results are unusual in relation to the other samples. There was contamination of both ammonium and nitrate-nitrite in the field blank, therefore it is assumed that these samples have been contaminated, possibly in the filtering process.

Nitrate+nitrite concentrations were lowest in the surface water at all sites deeper than 200 m. At these deeper sites the nitrate-nitrite concentrations in the mid water sample were comparatively high and ranged from 170 to 250 µg/L and they were higher again in the bottom water and ranged from 330 to 400 µg/L. For the sites of

approximately 100 m depth, the nitrate+nitrite concentrations in the surface and mid waters were low ($< 5 \mu\text{g/L}$), while the bottom water was higher (140 to 180 $\mu\text{g/L}$). The nitrate-nitrite concentrations at the shallow sites ($< 30 \text{ m}$) had comparably lower nitrate-nitrite concentrations in both the surface and bottom water ($\leq 7 \mu\text{g/L}$). Therefore, the deeper the depth the sample was taken the higher the nitrate-nitrite concentration.

Total nitrogen concentrations were low in the surface samples with concentrations ranging between 80 and 110 $\mu\text{g/L}$ at all sites. Again the total nitrogen concentrations increased as the depth of the sample increased, with the concentrations in the bottom water of the deepest sites (SP1, SP2, SP3 and SP6) ranged from 380 to 400 $\mu\text{g/L}$.

Summer

While just over half the sites there was little or no detectable ammonium at any depth, sites SP2-M, SP2-B, SP4-B, SP5-B, SP6-S, SP6-M, SP6-B, SP7-S, SP8-M, SP8-B, SP9-S, SP9-M, SP9-B, SP10-B, SP11-S, SP12-S, SP12-M, SP12-B, SP13-S and SP14-S had detectable results. This was unusual in relation to the other samples (in that there was no pattern to the results, e.g. only detectable results in the bottom water) and samples taken on previous occasions (in which ammonium at all depths were below laboratory detection limits). This indicates these samples have been contaminated, possibly via a connection to the Niskin bottle that enables bottles to be filled directly.

Nitrate+nitrite concentrations were lowest in the surface water at all sites. All surface water values measured during the survey were below the ANZECC & ARMCANZ (2000a) summer trigger value of 4 $\mu\text{g/L}$. At the deepest sites the nitrate+nitrite concentrations in the mid-water sample were comparatively high and ranged from 150 to 230 $\mu\text{g/L}$, and in the bottom water sample ranged from 280 to 380 $\mu\text{g/L}$. For the sites of approximately 100 m depth, the nitrate-nitrite concentrations in the surface and mid-waters were low ($\leq 5 \mu\text{g/L}$) and higher in bottom waters (180–210 $\mu\text{g/L}$). The nitrate+nitrite concentrations at the shallow sites ($< 30 \text{ m}$) were low and similar in both the surface and bottom water ($\leq 2 \mu\text{g/L}$).

Total nitrogen concentrations were low in the surface samples with concentrations ranging between 80 and 120 $\mu\text{g/L}$ at all sites. Again, total nitrogen concentrations increased with depth, with the highest concentrations recorded in the bottom water of the deepest sites (SP1, SP2, SP3 and SP6), ranging from 400 to 420 $\mu\text{g/L}$.

Autumn

Detectable ammonia results were recorded at sites SP15-S, SP15-B and SP17-B. At least one of these was considered to be due to contamination in the filtering process. All surface water values measured during this survey were below this level. At the deepest sites, the nitrate+nitrite concentrations were relatively high in the mid-water samples, ranging from 64 $\mu\text{g/L}$ to 200 $\mu\text{g/L}$, and even higher in the bottom water samples, ranging from 310 $\mu\text{g/L}$ to 360 $\mu\text{g/L}$. For the sites of approximately 100 m depth, the nitrate+nitrite concentrations in the surface and mid-waters were low ($< 2 \mu\text{g/L}$) but concentrations were higher in the bottom waters (74 $\mu\text{g/L}$ to 120 $\mu\text{g/L}$). The nitrate+nitrite concentrations at the shallow sites ($< 30 \text{ m}$) were low and similar in both the surface and bottom water ($< 2 \mu\text{g/L}$).

Total nitrogen concentrations were low in the surface samples with concentrations ranging between 80 and 100 $\mu\text{g/L}$ at all sites. Again, total nitrogen concentrations increased with depth, with the highest concentrations recorded in the bottom water of the deepest sites (SP1, SP2, SP3 and SP6), ranging from 350 $\mu\text{g/L}$ to 360 $\mu\text{g/L}$.

Phosphorus

Total phosphorus consists of orthophosphate and organic phosphate. Orthophosphate concentrations in the surface water samples at all sites were $\leq 5 \mu\text{g/L}$ (**Table 3-3** to **Table 3-6**).

The sites where total phosphorus was detected during each sampling event and any trends in the surveys are discussed below.

Winter

Orthophosphate concentrations in the surface water samples at all sites were $\leq 5 \mu\text{g/L}$. The bottom water of the shallowest sites or the middle water of the sites in approximately 100 m water depth had orthophosphate concentrations similar to the surface those in the surface water. The middle waters of the deepest sites were higher ranging from 26 to 34 $\mu\text{g/L}$, whilst the bottom water was higher again ranging from 51 $\mu\text{g/L}$ to 61 $\mu\text{g/L}$. The total phosphorus concentrations were similar to the orthophosphate concentrations in that they increased with an increase in depth. Therefore, phosphorus concentrations in the surface layers were low and mainly comprised of organic phosphorus and the bottom layers were high and mainly comprised of orthophosphate. All surface water samples collected during this survey had orthophosphate concentrations that were at or below the ANZECC & ARMCANZ (2000a) guidelines default winter trigger value of 10 $\mu\text{g/L}$.

Summer

Orthophosphate concentrations in the surface water samples at all sites were $\leq 5 \mu\text{g/L}$. The bottom water of the shallowest sites and the middle water of sites in approximately 100 m water depth had orthophosphate concentrations similar to those measured in surface waters. The deepest sites had higher concentrations, ranging from 23 to 35 $\mu\text{g/L}$ in the middle waters and from 39 to 56 $\mu\text{g/L}$ in the bottom waters.

All surface water samples collected during this survey had orthophosphate concentrations that were at or below the ANZECC & ARMCANZ (2000a) guidelines default summer trigger value of 5 $\mu\text{g/L}$.

Autumn

Orthophosphate concentrations in the surface water samples at all sites were $\leq 3 \mu\text{g/L}$. The bottom water of the shallowest sites and the middle water of sites in approximately 100 m water depth had orthophosphate concentrations similar to those measured in surface waters. The deepest sites had higher concentrations, ranging from 15 $\mu\text{g/L}$ to 33 $\mu\text{g/L}$ in the mid-waters and from 53 $\mu\text{g/L}$ to 61 $\mu\text{g/L}$ in the bottom waters.

All surface water samples collected during this survey had orthophosphate concentrations that were at or below the ANZECC & ARMCANZ (2000a) guidelines default winter trigger value.

In summary, total phosphorus concentrations showed similar patterns to the orthophosphate concentrations, increasing with depth, with low phosphorus concentrations in the surface layers (mainly comprising of organic phosphorus) and high concentrations in the bottom layers (mainly comprising of orthophosphate).

Pigments

Chlorophyll *a* concentrations (as a proxy for phytoplankton biomass) in all surface water samples from the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank were low during all surveys, in the range of $\leq 0.9 \mu\text{g/L}$ (**Table 3-3** to **Table 3-6**). Chlorophyll *a* concentrations in samples from water depths greater than 100 m were generally at or below the laboratory detection limits (LOR $< 0.1 \mu\text{g/L}$). During the summer survey, the highest chlorophyll *a* concentrations were mid-water at sites in approximately 100 m of water, suggesting the euphotic zone reached a depth of approximately 50 m during the survey.

Chlorophyll *a* concentrations were at or below the ANZECC & ARMCANZ (2000a) default trigger value of 0.9 $\mu\text{g/L}$ at all sites and all depths during all surveys.

Phaeophytin is the breakdown product of chlorophyll *a* and is analysed more frequently in lakes to determine if phytoplankton blooms are increasing or declining. Phaeophytin concentrations were below the laboratory LOR for all sites and depths during all surveys. There are no ANZECC & ARMCANZ (2000b) default trigger values for phaeophytin.

3.2.2 Metals/metalloids

The metal/metalloid samples were processed as either unfiltered or filtered, with the unfiltered generally defining the total metals in solution, including those bound to particles (considered 'unavailable') and those that are bioavailable or possibly toxic to organisms (depending on the type of metal and the concentration). ANZECC & ARMCANZ (2000a) guidelines recommend that unfiltered samples be taken and if metal/metalloids are found to

be above recommended concentrations, then filtered samples should also be taken to determine bioavailability of the metal/metalloids. The filtered metals/metalloids generally define those compounds that are bioavailable or possibly toxic to organisms, as all but the very fine particles (< 0.2 µm) are filtered out of the sample. If bioavailable metals/metalloids are found above recommended concentrations, then additional samples should be taken to determine if the detected concentrations are toxic.

The results from the metals/metalloids survey are presented in **Table 3-7** to **Table 3-14**. The trends and exceedences for metals/metalloids associated with each survey are discussed below.

Winter

Of the total metal/metalloids in the water sampled from the various depths at the permit area, Evans Shoal and Tassie Shoal sites, only copper was above the ANZECC & ARMCANZ (2000) trigger value for 99% species protection of 0.3 µg/L (**Table 3-7** to **Table 3-9**).

After filtering, the copper concentrations at four sites (SP2-M, SP7-B, SP10-M and SP14-B) were slightly above 0.3 µg/L (**Table 3-10** to **Table 3-13**). The copper concentrations at sites SP1-S, SP5-S and SP11-S were considered to be high and possibly due to contamination as they were higher than the unfiltered samples. Therefore, they have been excluded from the results.

Of the other total metals, lead, mercury, cadmium and cobalt were below the laboratory LORs at all depths at the permit area, Evans Shoal and Tassie Shoal sampling sites during the winter survey (**Table 3-7** to **Table 3-9**).

Total barium concentrations at all sites and depths ranged from 5.3 µg/L to 7.9 µg/L with the deepest water comprising the highest concentrations (**Table 3-7** to **Table 3-9**). Filtered barium concentrations were similar to total barium concentrations at the permit area, Evans Shoal and Tassie Shoal sampling sites and depths (**Table 3-10** to **Table 3-13**).

Total chromium concentrations were below the laboratory LOR (< 0.2 µg/L) in all surface samples at the permit area, Evans Shoal and Tassie Shoal sites and at the laboratory LOR (or slightly higher for the deepest depths) for all bottom depths greater than 100 m of water (**Table 3-7** to **Table 3-9**). Filtered chromium concentrations were similar to the total chromium concentrations (**Table 3-10** to **Table 3-13**).

Total nickel concentrations were below the laboratory LOR (< 0.3 µg/L) in all surface samples and the majority of middle depth samples that were taken in less than 100 m of water, while bottom water concentrations at all sites deeper than 100 m of water ranged from 0.3–0.4 µg/L (**Table 3-7** to **Table 3-9**). Filtered nickel concentrations were similar to the total concentrations (**Table 3-10** to **Table 3-13**).

There did not appear to be a particular pattern regarding change of total zinc concentrations with depth, as per the other metals. Total zinc concentrations at all depths ranged from below the laboratory LOR to 4 µg/L (**Table 3-7** to **Table 3-9**). Filtered zinc concentrations were similar to total zinc concentrations (**Table 3-10** to **Table 3-13**), but all were below the ANZECC & ARMCANZ (2000) trigger value of 7 µg/L.

Total arsenic and filtered arsenic concentrations were very similar at all depths of the permit area, Evans Shoal and Tassie Shoal sites and ranged from 1.5 µg/L to 2.0 µg/L (**Table 3-10** to **Table 3-13**), which is below the ANZECC & ARMCANZ (2000) trigger value of 4.5 µg/L.

Summer

Of the total metals/metalloids in the water sampled from the various depths at the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sites, only copper was above the ANZECC & ARMCANZ (2000a) trigger value of 0.3 µg/L for 99% species protection (**Table 3-7** to **Table 3-10**). After filtering, the copper concentrations at five sites (SP2-S, SP7-S, SP9-M, SP10-B and SP13-S) were slightly above 0.3 µg/L (**Table 3-11** to **Table 3-14**). The high copper concentrations at sites SP8-B, SP11-S and SP12-M were possibly due to contamination as they were higher than the unfiltered samples.

Of the other total metals, cadmium, cobalt, chromium, lead and mercury were all below the laboratory LORs at all depths at the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sampling sites during the summer survey (**Table 3-7 to Table 3-10**).

Total barium concentrations ranged from 5.0 µg/L to 7.0 µg/L at all sites and depths, with the deepest water samples comprising the highest concentrations (**Table 3-7 to Table 3-10**). Filtered barium concentrations were similar to total barium concentrations at each of permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sampling sites and depths (**Table 3-11 to Table 3-14**). There is no ANZECC & ARMCANZ (2000a) trigger value for barium.

Total nickel concentrations were below the laboratory LOR (<0.3 µg/L) in all surface samples and in most mid-water samples in <100 m of water, whereas bottom water concentrations at all sites >100 m of water were 0.3 µg/L–0.5 µg/L (**Table 3-7 to Table 3-10**). Filtered nickel concentrations were similar to the total concentrations (**Table 3-11 to Table 3-14**). The ANZECC & ARMCANZ (2000a) trigger value for nickel in marine water protecting 99% of species is 7 µg/L.

There did not appear to be a particular pattern regarding total zinc concentrations with depth. Total zinc concentrations at all depths ranged from below the laboratory LOR to 4 µg/L (**Table 3-7 to Table 3-10**). Filtered zinc concentrations were similar to total zinc concentrations (**Table 3-11 to Table 3-14**), and all were below the ANZECC & ARMCANZ (2000a) trigger value of 7 µg/L.

Total arsenic and filtered arsenic concentrations were similar at all depths of all the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sites and ranged from 1.5 µg/L to 1.9 µg/L (**Table 3-7 to Table 3-14**), below the ANZECC & ARMCANZ (2000a) trigger value of 4.5 µg/L.

Autumn

Of the total metals/metalloids in the water sampled from the various depths at the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sites, none were above the ANZECC & ARMCANZ (2000a) trigger values for 99% species protection in marine water (**Table 3-7 to Table 3-10**), where trigger values were available

Copper concentrations were generally below the laboratory LOR for most sites and depths sampled during this survey (**Table 3-7 to Table 3-10**). No sites had samples that were above the ANZECC & ARMCANZ (2000a) trigger value of 0.3 µg/L but filtered samples for sites SP12-S and SP12-B equalled the trigger value (**Table 3-11 to Table 3-14**).

Total nickel concentrations were below the laboratory LOR (<0.3 µg/L) in all surface samples and most mid water samples from sites in less than 100 m of water, while bottom water concentrations at all sites deeper than 100 m of water ranged from 0.3 µg/L to 0.5 µg/L (**Table 3-7 to Table 3-10**).

The total metals, cadmium, cobalt, lead and mercury were all below the laboratory LORs at all depths at the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sampling sites during the autumn survey (**Table 3-7 to Table 3-10**).

Total arsenic and filtered arsenic concentrations were similar at all depths of all the permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sites and ranged from 1.3 µg/L to 2.1 µg/L (**Table 3-7 to Table 3-14**), which is below the ANZECC & ARMCANZ (2000a) trigger value of 4.5 µg/L.

Total barium concentrations ranged from 5.0 µg/L to 8.2 µg/L at all sites and depths, with the deepest water samples comprising the highest concentrations (**Table 3-7 to Table 3-10**). Filtered barium concentrations were similar to total barium concentrations at each of permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank sampling sites and depths (**Table 3-11 to Table 3-14**). There is no ANZECC & ARMCANZ (2000a) trigger value for barium but there are guideline values for drinking water NHMRC & ARMCANZ (2011). Barium has a human health guideline for drinking water of 2000 µg/L, much higher than the concentrations reported in this survey. In Australian drinking water supplies, barium ranges from <2 µg/L to 1,100 µg/L.

Total chromium and filtered chromium concentrations were below LOR in the surface water of all sites in and around permit area, Evans Shoal, Tassie Shoal and Lynedoch Bank (**Table 3-7** to **Table 3-14**). Chromium concentrations were slightly above the LOR in samples from the deepest sites. All samples were below the ANZECC & ARMCANZ (2000a) trigger value of 7.7 µg/L.

Filtered nickel concentrations were similar to the total concentrations (**Table 3-11** to **Table 3-14**). The ANZECC & ARMCANZ (2000a) trigger value for nickel in marine water protecting 99% of species is 7 µg/L.

There was no trend in total zinc concentrations with depth. Total zinc concentrations at all depths ranged from below the laboratory LOR to 3 µg/L (**Table 3-7** to **Table 3-10**). Filtered zinc concentrations were similar to total zinc concentrations (**Table 3-11** to **Table 3-14**) and all were below the ANZECC & ARMCANZ (2000a) trigger value of 7 µg/L.

Table 3-3: Nutrient concentrations at permit area sites

Parameter	Ammonium		Nitrate+nitrite		Total nitrogen		Orthophosphate		Total phosphorus		Chlorophyll a		Phaeophytin	
	W	S	W	S	W	S	W	S	W	S	W	S	W	S
Units		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L
LOR	<3	<3	<2	<2	90	90	5	4	2	15	13	11	0.36	0.1
Guideline ¹	9 ²	9 ²	5 ²	5 ²	300	300	33	35	33	38	42	40	<0.05	<0.1
	4 ³	4 ³	4 ³	4 ³	440	440	60	56	60	65	62	65	<0.05	<0.1
					220	110	5	4	2	15	13	12	0.43	<0.1
					310	270	34	32	26	39	36	33	<0.05	<0.1
					430	420	61	54	58	65	59	63	<0.05	<0.1
					110	90	5	3	<2	15	14	12	0.50	<0.1
					280	270	35	31	31	41	36	41	<0.05	<0.1
					420	400	59	39	61	64	58	65	<0.05	<0.1
					90	80	5	4	2	14	14	12	0.21	0.1
					240	230	28	27	27	34	33	34	0.07	<0.1
					380	360	54	47	54	57	51	58	<0.05	<0.1
					80	100	4	4	2	13	13	12	0.41	0.1
					220	260	26	34	26	31	40	34	0.08	<0.1
					390	360	52	46	53	55	52	58	<0.05	<0.1
					90	100	5	3	2	14	14	12	0.16	0.1
					200	260	34	23	33	38	35	39	<0.05	<0.1
					440	440	60	43	59	64	57	64	<0.05	<0.1

W – winter; S – summer; A – autumn

¹ The ANZECC & ARMICANZ (2000b) default trigger values for chemical stressors for tropical Australia for slightly disturbed offshore marine ecosystems.

² Winter values.

³ Summer values.

Table 3-4: Nutrient concentrations at Evans Shoal sites

Parameter	Ammonium		Nitrate+nitrite		Total nitrogen		Orthophosphate		Total phosphorus		Chlorophyll a		Phaeophytin	
	W	S	W	S	W	S	W	S	W	S	W	S	W	S
Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
Limit of reporting	<3		<2		<50		<2		<5		<0.1		<0.2	
Guideline ¹	9 ² 4 ³		5 ² 4 ³		140 ^{2,3}		10 ² 5 ³		10 ² 5 ³		0.9 ^{2,3}		-	
Season	W	S	W	S	W	S	W	S	W	S	W	S	W	S
Site														
SP7-S	<3	4	<3	2	80	100	5	4	13	12	12	0.22	0.1	<0.2
SP7-B	6	<3	<3	2	80	90	6	4	14	13	12	0.45	0.2	<0.2
SP8-S	NS	<3	<2	<2	NS	90	NS	4	NS	12	12	NS	0.2	NS
SP8-M	NS	5	<2	<2	NS	80	NS	5	NS	14	12	NS	0.3	NS
SP8-B	NS	3	<3	170	NS	240	NS	25	NS	32	12	NS	0.2	NS
SP9-S	NS	5	<2	2	NS	90	NS	5	NS	14	12	NS	0.1	NS
SP9-M	NS	5	<2	190	NS	310	NS	28	NS	35	12	NS	0.2	NS
SP9-B	NS	7	<3	180	NS	320	NS	32	NS	43	31	NS	<0.1	NS
SP10-S	<3	<3	<2	<2	100	80	5	5	14	14	12	0.18	0.1	<0.2
SP10-M	<3	<3	64	150	260	220	31	24	36	30	24	0.05	0.2	<0.2
SP10-B	<3	8	310	300	370	350	51	43	54	48	57	<0.05	<0.1	<0.2

W – winter; S – summer; A – autumn

¹The ANZECC & ARMCANZ (2000b) default trigger values for chemical stressors for tropical Australia for slightly disturbed offshore marine ecosystems.

² Winter values.

³ Summer values.

NS = no sample due to inclement weather conditions.

Table 3-5: Nutrient concentrations at Tassie Shoal sites

Parameter	Ammonium		Nitrate+nitrite		Total nitrogen		Orthophosphate		Total phosphorus		Chlorophyll a		Phaeophytin	
	W	S	W	S	W	S	W	S	W	S	W	S	W	S
Units		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L
Limit of reporting		<3		<2		<50		<2		<5		<0.1		<0.2
Guideline ¹		9 ²		5 ²		140 ^{2,3}		10 ²		10 ²		0.9 ^{2,3}		-
		4 ³		4 ³				5 ³		5 ³				
Season	W	S	W	S	W	S	W	S	W	S	W	S	W	S
Site														
SP11-S	<3	4	<3	<2	90	80	4	3	14	13	0.21	0.2	<0.1	<0.2
SP11-B	7	<3	<3	<2	110	110	4	3	14	13	0.35	0.3	0.1	<0.2
SP12-S	<3	4	<3	<2	90	120	4	4	14	14	0.17	0.2	<0.1	<0.2
SP12-M	<3	37	<3	3	90	90	4	7	12	15	0.42	0.8	0.1	<0.2
SP12-B	<3	4	<3	180	210	280	29	33	34	39	0.07	0.2	0.2	<0.2
SP13-S	<3	9	<3	<2	100	110	5	5	14	14	0.16	0.2	<0.1	<0.2
SP13-M	<3	<3	<3	<2	100	100	4	7	12	18	0.53	0.9	0.2	<0.2
SP13-B	<3	<3	<3	150	200	260	24	30	30	38	0.10	0.3	0.1	<0.2
SP14-S	7	5	<3	3	100	90	4	4	13	14	0.34	0.2	<0.1	<0.2
SP14-M	4	<3	<3	2	120	100	3	4	14	16	0.33	0.9	0.3	<0.2
SP14-B	3	<3	<3	140	190	250	23	30	29	37	0.07	0.3	0.1	<0.2

W – winter; S – summer; A – autumn

¹The ANZECC & ARMCANZ (2000b) default trigger values for chemical stressors for tropical Australia for slightly disturbed offshore marine ecosystems.

² Winter values.

³ Summer values.

Table 3-6: Nutrient concentrations at Lynedoch Bank sites

Parameter	Ammonium		Nitrate+nitrite		Total nitrogen		Orthophosphate		Total phosphorus		Chlorophyll a		Phaeophytin			
	W	S	W	S	W	S	W	S	W	S	W	S	W	S		
Units		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		
Limit of reporting		<3		<2		<50		<2		<5		<0.1		<0.2		
Guideline ¹		9 ²		5 ²		140 ^{2,3}		10 ²		10 ²		0.9 ^{2,3}		-		
		4 ³		4 ³				5 ³		5 ³						
Season	W	S	W	S	W	S	W	S	W	S	W	S	W	S		
Site																
SP15-S	NS	<3	4	NS	2	<2	NS	100	90	3	NS	13	12	NS	<0.2	<0.2
SP15-M	NS	<3	<3	NS	5	<2	NS	90	120	3	NS	15	14	NS	<0.2	<0.2
SP15-B	NS	<3	8	NS	190	110	NS	260	250	22	NS	37	36	NS	<0.2	<0.2
SP16-S	NS	<3	<3	NS	<2	<2	NS	80	100	2	NS	14	12	NS	<0.2	<0.2
SP16-B	NS	<3	<3	NS	<2	<2	NS	90	90	2	NS	13	12	NS	<0.2	<0.2
SP17-S	NS	<3	<3	NS	<2	<2	NS	100	100	2	NS	12	12	NS	<0.2	<0.2
SP17-M	NS	<3	<3	NS	16	7	NS	100	100	5	NS	16	14	NS	0.2	<0.2
SP17-B	NS	<3	9	NS	180	150	NS	250	240	29	NS	37	35	NS	<0.2	<0.2

W – winter; S – summer; A – autumn

¹ The ANZECC & ARMCANZ (2000b) default trigger values for chemical stressors for tropical Australia for slightly disturbed offshore marine ecosystems.

² Winter values.

³ Summer values.

NS = no sample due to inclement weather conditions.

Table 3-7: Total metal concentrations at permit area sites

Parameter	Arsenic		Barium		Cadmium		Chromium		Cobalt		Copper		Mercury		Nickel		Lead		Zinc			
	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S		
Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L			
Limit of reporting	<0.5		<0.5		<0.1		<0.2		<0.05		<0.2		<0.1		<0.3		<0.1		<1.0			
Guideline ¹	4.5 ²		-		0.7		7.7 ³		1.0		0.3		0.1		7.0		2.2		7.0			
Season	W		S		W		S		W		S		W		S		W		S			
Site	A		A		A		A		A		A		A		A		A		A			
SP1-S	1.8	1.6	1.9	5.6	5.1	5.9	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	2	1
SP1-M	1.9	1.7	1.9	5.6	5.5	6.1	<0.1	<0.1	0.2	<0.2	0.2	<0.2	0.2	<0.1	<0.1	0.4	<0.3	<0.1	<0.1	<0.1	<1	2
SP1-B	2.0	1.9	2.1	7.9	7.0	8.0	<0.1	<0.1	0.3	<0.2	0.3	<0.2	0.2	<0.2	<0.1	0.4	0.3	0.4	<0.1	<0.1	<1	1
SP2-S	1.7	1.6	1.8	5.5	5.2	5.5	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.5	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	3	1
SP2-M	1.9	1.8	1.8	5.7	5.6	5.8	<0.1	<0.1	0.2	<0.2	<0.2	<0.2	1.0	<0.1	<0.1	0.3	<0.3	<0.1	<0.1	<0.1	4	1
SP2-B	1.9	1.7	2.0	7.8	6.9	8.1	<0.1	<0.1	0.3	<0.2	0.2	<0.2	0.3	<0.1	<0.1	0.4	0.4	0.3	<0.1	<0.1	3	2
SP3-S	1.7	1.6	1.8	5.3	5.4	5.5	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.2	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	2	<1
SP3-M	1.8	1.8	1.8	5.5	5.6	5.9	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	<1	<1
SP3-B	1.8	1.8	2.1	7.5	6.3	8.2	<0.1	<0.1	0.3	<0.2	0.2	<0.2	0.3	<0.2	<0.1	0.3	0.4	0.5	<0.1	<0.1	<1	<1
SP4-S	1.6	1.6	1.8	5.5	5.2	5.6	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.2	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	<1	<1
SP4-M	1.8	1.7	1.7	5.7	5.0	5.6	<0.1	<0.1	0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	1	1
SP4-B	1.9	1.8	2.0	6.9	6.4	7.5	<0.1	<0.1	0.2	<0.2	0.2	<0.2	0.7	<0.2	<0.1	0.4	0.5	0.3	<0.1	<0.1	4	<1
SP5-S	1.7	1.6	1.6	5.3	5.3	5.0	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.3	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	2	<1
SP5-M	1.8	1.8	1.8	5.5	5.6	5.8	<0.1	<0.1	0.2	<0.2	<0.2	<0.2	<0.2	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	<1	<1
SP5-B	1.7	1.8	1.8	6.8	6.1	6.7	<0.1	<0.1	0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.1	0.4	0.3	0.3	<0.1	<0.1	2	<1
SP6-S	1.6	1.6	1.6	5.5	5.3	5.3	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.4	<0.1	<0.1	<0.3	<0.3	<0.1	<0.1	<0.1	2	<1
SP6-M	1.8	1.8	1.8	5.6	5.5	5.7	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.3	<0.2	<0.1	0.3	<0.3	<0.1	<0.1	<0.1	<1	2
SP6-B	1.9	1.8	1.9	7.7	6.8	7.6	<0.1	<0.1	0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.1	0.4	0.3	0.4	<0.1	<0.1	1	<1

¹ All trigger values listed are for ANZECC & ARMCANZ (2000a) 99% species protection, while that for cobalt is 95% species protection.

² Low reliability trigger value.

³ Value for Chromium III.

Values in bold are above the ANZECC & ARMCANZ (2000a) trigger value.

Table 3-8: Total metal concentrations at Evans Shoal sites

Parameter	Arsenic			Barium			Cadmium			Chromium			Cobalt			Copper			Mercury			Nickel			Lead			Zinc														
	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A									
Units	µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L			µg/L											
Limit of reporting	<0.5			<0.1			<0.2			<0.05			<0.05			<0.2			<0.2			<0.1			<0.3			<0.1			<1.0											
Guideline ¹	4.5 ²			0.7			7.7 ³			1.0			0.3			0.1			0.1			0.1			7.0			2.2			7.0											
Season	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A			
Site	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A
SP7-S	1.7	1.7	1.7	5.6	5.4	5.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	0.3	0.6	<0.2	<0.1	<0.1	<0.1	<0.3	<0.3	<0.3	<0.1	0.2	<0.1	<0.1	1	1	<1											
SP7-B	1.7	1.7	1.5	5.5	5.6	5.6	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	0.5	0.4	<0.2	<0.1	<0.1	<0.1	0.3	<0.3	<0.3	<0.1	<0.1	<0.1	<0.1	2	2	<1											
SP8-S	NS	1.6	1.6	NS	5.3	5.3	NS	<0.1	<0.1	NS	<0.2	<0.2	<0.05	<0.05	<0.05	NS	0.2	<0.2	NS	<0.1	<0.1	NS	<0.3	<0.3	NS	<0.1	<0.1	<0.1	NS	1	1											
SP8-M	NS	1.7	1.7	NS	5.6	5.5	NS	<0.1	<0.1	NS	<0.2	<0.2	<0.05	<0.05	<0.05	NS	0.4	0.2	NS	<0.1	<0.1	NS	<0.3	<0.3	NS	<0.1	<0.1	<0.1	NS	2	<1											
SP8-B	NS	1.8	1.7	NS	5.9	5.3	NS	<0.1	<0.1	NS	<0.2	<0.2	<0.05	<0.05	<0.05	NS	0.3	<0.2	NS	<0.1	<0.1	NS	<0.3	<0.3	NS	<0.1	<0.1	<0.1	NS	2	1											
SP9-S	NS	1.8	1.7	NS	5.6	5.4	NS	<0.1	<0.1	NS	<0.2	<0.2	<0.05	<0.05	<0.05	NS	0.3	<0.2	NS	<0.1	<0.1	NS	<0.3	<0.3	NS	0.2	<0.1	NS	1	2												
SP9-M	NS	1.8	1.8	NS	5.8	5.2	NS	<0.1	<0.1	NS	<0.2	<0.2	<0.05	<0.05	<0.05	NS	0.4	<0.2	NS	<0.1	<0.1	NS	0.3	<0.3	NS	<0.1	<0.1	NS	2	<1												
SP9-B	NS	1.9	1.9	NS	6.0	5.9	NS	<0.1	<0.1	NS	<0.2	<0.2	<0.05	<0.05	<0.05	NS	0.3	<0.2	NS	<0.1	<0.1	NS	0.4	<0.3	NS	<0.1	<0.1	NS	2	1												
SP10-S	1.6	1.7	1.7	5.5	5.6	5.5	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	0.3	0.2	<0.2	<0.1	<0.1	<0.1	<0.3	<0.3	<0.3	<0.1	<0.1	<0.1	<0.1	1	<1												
SP10-M	1.8	1.9	1.8	5.8	6.0	5.6	<0.1	<0.1	<0.1	0.2	<0.2	<0.2	<0.05	<0.05	<0.05	0.4	0.2	<0.2	<0.1	<0.1	<0.1	0.3	0.3	<0.3	<0.1	<0.1	<0.1	<0.1	2	3	<1											
SP10-B	1.8	1.9	1.9	6.7	6.4	7.4	<0.1	<0.1	<0.1	0.2	<0.2	<0.2	<0.05	<0.05	<0.05	0.4	0.4	0.2	<0.1	<0.1	<0.1	0.4	0.4	0.4	<0.1	<0.1	<0.1	<0.1	2	4	<1											

¹ All trigger values listed are for ANZECC & ARMCANZ (2000a) 99% species protection, while that for cobalt is 95% species protection.

² Low reliability trigger value.

³ Value for Chromium III.

Values in bold are above the ANZECC & ARMCANZ (2000a) trigger value.

NS = no sample due to inclement weather conditions.

Table 3-9: Total metal concentrations at Tassie Shoal sites

Parameter	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Mercury	Nickel	Lead	Zinc										
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L										
Limit of reporting	<0.5	<0.5	<0.1	<0.2	<0.05	<0.2	<0.1	<0.3	<0.1	<1.0										
Guideline ¹	4.5 ²	-	0.7	7.7 ³	1.0	0.3	0.1	7.0	2.2	7.0										
Season	W	S	A	W	S	A	W	S	A	W	S	A								
Site	W	S	A	W	S	A	W	S	A	W	S	A								
SP11-S	1.6	1.6	1.9	5.9	5.3	5.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP11-B	1.6	1.8	1.6	5.5	5.6	5.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP12-S	1.6	1.7	1.6	5.4	5.2	5.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP12-M	1.6	1.9	1.6	5.5	5.5	5.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP12-B	1.7	1.9	1.8	6.0	5.8	5.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP13-S	1.6	1.6	1.6	5.5	5.5	5.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP13-M	1.6	1.7	1.6	5.5	5.8	5.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP13-B	1.7	1.7	1.8	5.9	5.7	6.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP14-S	1.7	1.6	1.7	5.4	5.4	5.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP14-M	1.7	1.7	1.8	5.5	5.8	5.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP14-B	1.8	1.8	2.0	6.1	5.8	6.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

¹ All trigger values listed are for ANZECC & ARMCANZ (2000a) 99% species protection, while that for cobalt is 95% species protection.

² Low reliability trigger value.

³ Value for Chromium III.

Values in bold are above the ANZECC & ARMCANZ (2000a) trigger value.

Table 3-10: Total metal concentrations at Lynedoch Bank sites

Parameter	Arsenic		Barium		Cadmium		Chromium		Cobalt		Copper		Mercury		Nickel		Lead		Zinc		
	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	
Units																					
Limit of reporting		<0.5		<0.5		<0.1		<0.2		<0.05		<0.2		<0.1		<0.3		<0.1		<1.0	
Guideline ¹		4.5 ²		-		0.7		7.7 ³		1.0		0.3		0.1		7.0		2.2		7.0	
Season	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	
Site																					
SP15-S	NS	1.5	NS	5.6	NS	<0.1	<0.1	<0.2	NS	<0.05	NS	<0.2	NS	<0.1	NS	<0.3	NS	<0.1	NS	<1	
SP15-M	NS	1.8	NS	5.7	NS	<0.1	<0.1	<0.2	NS	<0.05	NS	<0.2	NS	<0.1	NS	<0.3	NS	<0.1	NS	<1	
SP15-B	NS	1.7	NS	5.8	NS	<0.1	<0.1	0.2	NS	<0.05	NS	<0.2	NS	<0.1	NS	<0.3	NS	<0.1	NS	<1	
SP16-S	NS	1.5	NS	5.5	NS	<0.1	<0.1	<0.2	NS	<0.05	NS	<0.2	NS	<0.1	NS	<0.3	NS	<0.1	NS	<1	
SP16-B	NS	1.7	NS	5.4	NS	<0.1	<0.1	<0.2	NS	<0.05	NS	<0.2	NS	<0.1	NS	<0.3	NS	<0.1	NS	<1	
SP17-S	NS	1.7	NS	5.6	NS	<0.1	<0.1	<0.2	NS	<0.05	NS	0.2	NS	<0.1	NS	<0.3	NS	<0.1	NS	<1	
SP17-M	NS	1.7	NS	5.7	NS	<0.1	<0.1	<0.2	NS	<0.05	NS	<0.2	NS	<0.1	NS	<0.3	NS	<0.1	NS	<1	
SP17-B	NS	1.8	NS	6.0	NS	<0.1	<0.1	<0.2	NS	<0.05	NS	<0.2	NS	<0.1	NS	0.4	NS	<0.1	NS	<1	

¹ All trigger values listed are for ANZECC & ARMCANZ (2000a) 99% species protection, while that for cobalt is 95% species protection.

² Low reliability trigger value.

³ Value for Chromium III.

Values in bold are above the ANZECC & ARMCANZ (2000a) trigger value.

NS = no sample due to inclement weather conditions.

Table 3-12: Filtered metal concentrations at Evans Shoal sites

Parameter	Arsenic		Barium		Cadmium		Chromium		Cobalt		Copper		Mercury		Nickel		Lead		Zinc		
	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		
Units																					
Limit of reporting	<0.5		<0.5		<0.1		<0.2		<0.05		<0.2		<0.1		<0.1		<0.1		<0.1		<1.0
Guideline ¹	4.5 ²		-		0.7		7.7 ³		1.0		0.3		0.1		7.0		2.2				7.0
Season	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A
Site																					
SP7-S	1.6	1.6	1.7	5.6	5.4	5.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
SP7-B	1.5	1.6	1.3	5.4	5.4	5.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1
SP8-S	NS	1.6	1.6	NS	5.4	5.2	NS	<0.1	<0.1	<0.1	NS	<0.2	<0.2	<0.2	NS	<0.2	NS	<0.1	<0.1	<0.1	<1
SP8-M	NS	1.6	1.6	NS	5.5	5.3	NS	<0.1	<0.1	<0.1	NS	<0.2	<0.2	<0.2	NS	<0.2	NS	<0.1	<0.1	<0.1	<1
SP8-B	NS	1.8	1.8	NS	5.6	5.1	NS	<0.1	<0.1	<0.1	NS	<0.2	<0.2	<0.2	NS	<0.2	NS	<0.1	<0.1	<0.1	<1
SP9-S	NS	1.8	1.8	NS	5.5	5.3	NS	<0.1	<0.1	<0.1	NS	<0.2	<0.2	<0.2	NS	<0.2	NS	<0.1	<0.1	<0.1	<1
SP9-M	NS	1.8	1.8	NS	5.6	5.0	NS	<0.1	<0.1	<0.1	NS	<0.2	<0.2	<0.2	NS	<0.2	NS	<0.1	<0.1	<0.1	<1
SP9-B	NS	1.9	1.7	NS	6.0	5.7	NS	<0.1	<0.1	<0.1	NS	<0.2	<0.2	<0.2	NS	<0.2	NS	<0.1	<0.1	<0.1	1
SP10-S	1.7	1.7	1.6	5.4	5.5	5.5	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.3	0.2	<0.2	<0.1	<0.1	<0.1	<1
SP10-M	1.7	1.8	1.8	5.8	5.9	5.6	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.2	<0.2	0.4	0.3	<0.2	<0.1	<0.1	<0.1	<1
SP10-B	1.8	1.9	1.9	6.8	6.3	7.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.2	0.2	0.3	0.4	<0.2	<0.1	<0.1	<0.1	<0.1	<1

¹ All trigger values listed are for ANZECC & ARMCANZ (2000a) 99% species protection, while that for cobalt is 95% species protection.

² Low reliability trigger value.

³ Value for Chromium III.

NS = no sample due to inclement weather conditions.

Table 3-14: Filtered metal concentrations at Lynedoch Bank sites

Parameter	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Mercury	Nickel	Lead	Zinc													
Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L													
Limit of reporting	<0.5	<0.5	<0.1	<0.2	<0.05	<0.2	<0.1	<0.3	<0.1	<1.0													
Guideline ¹	4.5 ²	-	0.7	7.7 ³	1.0	0.3	0.1	7.0	2.2	7.0													
Season	W	S	A	W	S	A	W	S	A	W	S	A											
Site	W	S	A	W	S	A	W	S	A	W	S	A											
SP15-S	NS	1.5	1.8	NS	5.6	5.5	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.1	<0.1	NS	<0.1	NS	<0.1	NS	<1	2	
SP15-M	NS	1.8	1.8	NS	5.6	5.7	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.05	<0.05	NS	<0.1	<0.1	NS	<0.1	NS	1	1
SP15-B	NS	1.7	1.9	NS	5.8	6.3	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.05	<0.05	NS	<0.1	<0.1	NS	<0.1	NS	<1	<1
SP16-S	NS	1.6	1.7	NS	5.6	5.4	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.05	<0.05	NS	<0.1	<0.1	NS	<0.1	NS	1	1
SP16-B	NS	1.6	1.7	NS	5.4	5.3	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.05	<0.05	NS	<0.1	<0.1	NS	<0.1	NS	1	1
SP17-S	NS	1.6	1.7	NS	5.7	5.6	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.05	<0.05	NS	<0.1	<0.1	NS	<0.1	NS	<1	4
SP17-M	NS	1.7	1.7	NS	5.7	5.6	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.05	<0.05	NS	<0.1	<0.1	NS	<0.1	NS	<1	1
SP17-B	NS	1.7	1.9	NS	5.9	6.3	NS	<0.1	<0.1	NS	<0.2	<0.2	NS	<0.05	<0.05	NS	<0.1	<0.1	NS	<0.1	NS	<1	2

¹ All trigger values listed are for ANZECC & ARMCANZ (2000a) 99% species protection, while that for cobalt is 95% species protection.

² Low reliability trigger value.

³ Value for Chromium III.

NS = no sample due to inclement weather conditions.

3.2.3 Hydrocarbons

TPHs at all sites and depths in and around the permit area, Evans Shoal Tassie Shoal and Lynedoch Bank were below the laboratory LORs during the summer and autumn surveys. Consequently, PAHs were not analysed. Results for all sites can be found in **Appendix C**. However, as an example, the results for all three depths at SP1 are shown in **Table 3-15**.

During the winter survey, two sites in the permit area (SP5-S and SP6-M) and one site at Evans Shoal (SP14-M) had TPH above the LOR, the results of which are shown in **Table 3-16**. TPH was 130 µg/L for the fraction C₁₅–C₂₈ at site SP5-S, 230 µg/L for the fraction C₁₅–C₂₈ at site SP6-M and 190 µg/L for the fraction C₂₉–C₃₆ at site SP14-M. Hydrocarbons in diesel fuel range from approximately C₁₁–C₂₀ (Agency for Toxic Substances and Disease Registry 1999). It is possible that the open Niskin bottle passed through the surface water in which traces of diesel fuel from the boat had been released and contaminated the sample. However, as the TPH at SP14-M was from a higher hydrocarbon fraction it would appear that there were two sources of contamination. If there were areas of natural hydrocarbon seepage that occurred in the sampling area then hydrocarbons would be present in all fractions. In addition, there was little difference in the hydrocarbon profiles (**Section 3.1.9**) between sites, which would also indicate a lack of hydrocarbons in the areas sampled.

There is a low reliability trigger value for TPH C₁₀–C₃₆ for 99% species protection of 7 µg/L (ANZECC & ARMCANZ 2000b). However, the laboratory LORs were above this value so it is difficult to determine if any exceedances have occurred. In cases where the trigger values are lower than the LOR the reporting of results should be either 'detected' or 'not detected' unless a better LOR can be achieved. In the past, TPH was analysed according to carbon chains C₆–C₉, C₁₀–C₁₄, C₁₅–C₂₈ and C₂₉–C₃₆ but in an attempt to incorporate health and ecological screening levels for petroleum hydrocarbons, the National Environment Protection Council released National Environment Protection Measures (NEPC 2013) which resulted in changes in the carbon chain divisions considered. This was based on analytical factors such as physical and chemical properties and the availability of toxicity data. This new analysis of hydrocarbons is called TRHs and includes BTEXN.

The BTEXN at all depths for permit area, Evans Shoal and Tassie Shoal sites were also below the LOR (**Table 3-15** and **Table 3-16**).

Table 3-15: TPHs, TRHs and BTEXN at site SP1

Compound Season ¹	LOR (µg/L)	Sample ²								
		SP1-S (µg/L)			SP1-M (µg/L)			SP1-B (µg/L)		
		W	S	A	W	S	A	W	S	A
TPHs										
C ₆ -C ₉	20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C ₁₀ -C ₁₄	50	<50	<20	<50	<50	<20	<50	<50	<20	<50
C ₁₅ -C ₂₈	100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C ₂₉ -C ₃₆	50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C ₁₀ -C ₃₆ (sum)	50	<50	<50	<50	<50	<50	<50	<50	<50	<50
TRHs										
C ₆ -C ₁₀	20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C ₆ -C ₁₀ minus BTEX	20	<20	<20	<20	<20	<20	<20	<20	<20	<20
>C ₁₀ -C ₁₆	100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C ₁₆ -C ₃₄	100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C ₃₄ -C ₄₀	100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C ₁₀ -C ₄₀ (sum)	100	<100	<100	<100	<100	<100	<100	<100	<100	<100
BTEXN										
Benzene	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-xylene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ortho-xylene	2	-	-	<2	-	-	<2	-	-	<2
Total xylene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	5	<5	<5	<5	<5	<5	<5	<5	<5	<5

¹ W = winter, S = summer, A = autumn

² -S = near surface water, -M = mid-water, -B = near bottom water.

Table 3-16: TPHs, TRHs and BTEXN at sites SP5-S, SP6-M and SP14-M

Compound Season ¹	LOR (µg/L)	Sample ²								
		SP5-S (µg/L)			SP6-M (µg/L)			SP14-M (µg/L)		
		W	S	A	W	S	A	W	S	A
TPHs										
C ₆ -C ₉	20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C ₁₀ -C ₁₄	50	<50	<20	<50	<50	<20	<50	<20	<20	<50
C ₁₅ -C ₂₈	100	140	<100	140	310	<100	310	<100	<100	<100
C ₂₉ -C ₃₆	50	<50	<50	<50	<50	<50	<50	190	<50	190
C ₁₀ -C ₃₆ (sum)	50	140	<50	140	310	<50	310	190	<50	190
TRHs										
C ₆ -C ₁₀	20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C ₆ -C ₁₀ minus BTEX	20	<20	<20	<20	<20	<20	<20	<20	<20	<20
>C ₁₀ -C ₁₆	100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C ₁₆ -C ₃₄	100	130	<100	130	230	<100	230	180	<100	180
>C ₃₄ -C ₄₀	100	<100	<100	<100	<100	<100	<100	220	<100	220
>C ₁₀ -C ₄₀ (sum)	100	130	<100	130	230	<100	230	400	<100	400
BTEXN										
Benzene	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-xylene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total xylene	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	5	<5	<5	<5	<5	<5	<5	<5	<5	<5

¹ W = winter, S = summer, A = autumn

² -S = near surface water, -M = mid-water, -B = near bottom water.

3.2.4 Naturally occurring radioactive materials

Winter

Radium²²⁶ was found above the laboratory minimum reporting limit (MRL) at one location during the survey, at SP4-M. Radium²²⁸ was above the MRL at a number of different sites including SP1-S, SP2-S, SP2-M, SP3-S and SP4-M all within the permit area and SP14-B in the Evans Shoal area. Thorium²²⁸ concentrations were all below the MRL at all depths for all sites (Table 3-17, Table 3-18 and Table 3-19).

Summer

Radium²²⁶ was found above the laboratory MRL in four samples; SP2-B, SP4-S, SP4-M and SP15-M. Radium²²⁸ was slightly above the MRL for SP2-B, SP4-B and SP8-B. Thorium²²⁸ concentrations were all below the MRL at all depths for all sites (Table 3-17, Table 3-18, Table 3-19 and Table 3-20). There are no ANZECC & ARMCANZ (2000a) trigger values for these radionuclides.

Autumn

Radium²²⁶ was found above the laboratory MRL in eight samples (SP2-M, SP4-S, SP5-M, SP7-B, SP8-S, SP9-S, SP11-S and SP12-M). Radium²²⁸ was slightly above the MRL for SP4-S. Thorium²²⁸ concentrations were all below the MRL at all depths for all sites (Table 3-17, Table 3-18, Table 3-19 and Table 3-20). There are no ANZECC & ARMCANZ (2000a) trigger values for these radionuclides.

Table 3-17: Naturally occurring radioactive materials at permit area sites

Parameter	Radium ²²⁶			Radium ²²⁸			Thorium ²²⁸			
	Units	(Bq/L)			(Bq/L)			(Bq/L)		
Minimum reporting limit (MRL)		0.1			0.1			0.1		
Season ¹	W	S	A	W	S	A	W	S	A	
Site/sample²										
SP1-S	<0.1	<0.1	<0.1	0.123 ± 0.061	<0.1	<0.1	<0.1	<0.1	<0.1	
SP1-M	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP1-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP2-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP2-M	<0.1	<0.1	0.124 ± 0.014	0.493 ± 0.176	<0.1	<0.1	<0.1	<0.1	<0.1	
SP2-B	<0.1	0.114 ± 0.025	<0.1	0.297 ± 0.103	0.116 ± 0.053	<0.1	<0.1	<0.1	<0.1	
SP3-S	<0.1	<0.1	<0.1	0.230 ± 0.068	<0.1	<0.1	<0.1	<0.1	<0.1	
SP3-M	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP3-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP4-S	<0.1	0.115 ± 0.014	0.295 ± 0.053	<0.1	<0.1	0.165 ± 0.064	<0.1	<0.1	<0.1	
SP4-M	0.175 ± 0.068	0.107 ± 0.048	<0.1	0.110 ± 0.050	<0.1	<0.1	<0.1	<0.1	<0.1	
SP4-B	<0.1	<0.1	<0.1	<0.1	0.109 ± 0.039	<0.1	<0.1	<0.1	<0.1	
SP5-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP5-M	<0.1	<0.1	0.104 ± 0.014	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP5-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP6-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP6-M	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
SP6-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	

¹ W = winter, S = summer, A = autumn.

² -S = near surface water, -M = mid-water, -B = near bottom water.

Table 3-18: Naturally occurring radioactive materials at Evans Shoal sites

Parameter	Radium ²²⁶			Radium ²²⁸			Thorium ²²⁸		
	(Bq/L)								
Units	0.1			0.1			0.1		
MRL	0.1			0.1			0.1		
Season ¹	W	S	A	W	S	A	W	S	A
Site/sample²									
SP7-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP7-B	<0.1	<0.1	0.141 ± 0.025	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP8-S	NS	<0.1	0.136 ± 0.019	NS	<0.1	<0.1	NS	<0.1	<0.1
SP8-M	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1
SP8-B	NS	<0.1	<0.1	NS	0.112 ± 0.020	<0.1	NS	<0.1	<0.1
SP9-S	NS	<0.1	0.113 ± 0.022	NS	<0.1	<0.1	NS	<0.1	<0.1
SP9-M	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1
SP9-B	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1
SP10-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP10-M	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP10-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

¹ W = winter, S = summer, A = autumn.

² -S = near surface water, -M = mid-water, -B = near bottom water.

NS = no sample due to inclement weather conditions.

Table 3-19: Naturally occurring radioactive materials at Tassie Shoal sites

Parameter	Radium ²²⁶			Radium ²²⁸			Thorium ²²⁸		
	(Bq/L)								
Units	0.1			0.1			0.1		
MRL	0.1			0.1			0.1		
Season ¹	W	S	A	W	S	A	W	S	A
Site/sample²									
SP11-S	<0.1	<0.1	0.172 ± 0.031	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP11-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP12-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP12-M	<0.1	<0.1	0.105 ± 0.015	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP12-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP13-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP13-M	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP13-B	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP14-S	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP14-M	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SP14-B	<0.1	<0.1	<0.1	0.249 ± 0.097	<0.1	<0.1	<0.1	<0.1	<0.1

¹ W = winter, S = summer, A = autumn.

² -S = near surface water, -M = mid-water, -B = near bottom water.

NS = no sample due to inclement weather conditions.

Table 3-20: Naturally occurring radioactive materials at Lynedoch Bank sites

Parameter	Radium ²²⁶			Radium ²²⁸			Thorium ²²⁸			
	Units	(Bq/L)			(Bq/L)			(Bq/L)		
MRL		0.1			0.1			0.1		
Season ¹	W	S	A	W	S	A	W	S	A	
Site/sample²										
SP15-S	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	
SP15-M	NS	0.133 ± 0.047	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	
SP15-B	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	
SP16-S	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	
SP16-B	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	
SP17-S	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	
SP17-M	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	
SP17-B	NS	<0.1	<0.1	NS	<0.1	<0.1	NS	<0.1	<0.1	

¹ W = winter, S = summer, A = autumn.

² -S = near surface water, -M = mid-water, -B = near bottom water.
NS = no sample due to inclement weather conditions.

3.3 Phytoplankton and zooplankton

Winter

Marine phytoplankton from the diatoms (Bacillariophyceae), the blue-green algae (Cyanobacteria), the silicoflagellates (Dictyochophyceae) and dinoflagellates (Dinophyceae) were captured in the plankton net tows in the permit area (SP3, SP5 and SP6), the Evans Shoal area (SP7 and SP10) and the Tassie Shoal area (SP14) (**Table 3-21**). Blue-green algae (comprised solely of *Trichodesmium erythraeum*) were captured in the greatest abundance (greater than 54%) at the majority of sites, however at SP14 the abundance of diatoms was much higher (greater than 92%). The diversity of the diatoms was highest at each site with up to 35 different species being identified. These Classes have been subdivided into the lowest taxonomic order possible in **Appendix C**.

Of the marine zooplankton captured in the plankton net tows, organisms from the Classes Trizonidae and Copepoda were in the highest abundance (**Table 3-22**). The greatest number of species were identified from SP3 with SP5 having the least. The Copepoda Class contain the highest number of different species whereas the majority of other Classes contained only one. These Classes have been subdivided into the lowest taxonomic order possible in **Appendix C**.

Summer

Marine phytoplankton captured at the permit area (SP1, SP3, SP5 and SP6), Evans Shoal (SP7, SP8 and SP10), Tassie Shoal (SP11, SP13 and SP14) and Lynedoch Bank (SP16 and SP17) consisted of diatoms (Bacillariophyceae), cryptomonads (Cryptophyceae), blue-green algae (Cyanobacteria) and dinoflagellates (Dinophyceae) (**Table 3-21**). Blue-green algae (comprised solely of *Trichodesmium erythraeum*) were captured in the greatest abundance (greater than 71%) at all sites. Diatoms were the most diverse group at all sites with up to 27 different species present. These (sub) Classes were identified to the lowest taxonomic order possible (**Appendix C**). This combination of species and diversity was similar to the winter survey. The phytoplankton assemblage composition and diversity in summer was similar to winter, although silicoflagellates (Dictyochophyceae) were more abundant in winter and cryptomonads (Cryptophyceae) were only present in summer.

Of the marine zooplankton captured during the summer survey, copepods were the only ones present at every site (**Table 3-23**). Trizonidae, Copepoda and Polycystinea were highest in abundance. The greatest diversity of zooplankton species was observed at SP7, while the lowest diversity was observed at SP5. Copepods displayed the highest number of different species whereas most other Classes contained only one species. These Classes were subdivided into the lowest taxonomic order possible (**Appendix C**).

Autumn

Marine phytoplankton captured at the permit area (SP1, SP3, SP5 and SP6), at Evans Shoal (SP7, SP8 and SP10), at Tassie Shoal (SP11, SP13 and SP14) and at Lynedoch Bank (SP16 and SP17) consisted of diatoms (Bacillariophyceae), green algae (Chlorophyceae), cryptomonads (Cryptophyceae), blue-green algae (Cyanobacteria) and dinoflagellates (Dinophyceae) (**Table 3-21**). Blue-green algae (comprised solely of *Trichodesmium erythraeum*) were captured in the greatest abundance (greater than 44%) at most sites except at Tassie Shoal where they were not present and dinoflagellates were most abundant. These (sub) Classes were identified to the lowest taxonomic order possible (**Appendix C**).

Of all marine zooplankton captured, copepods were the only ones present at every site (**Table 3-24**). Copepoda and Gigartacotidae were highest in abundance. Copepods displayed the highest number of different species whereas the majority of other Classes contained only one species (**Appendix C**).

Table 3-21: Composition (%) of phytoplankton at each site – winter, summer and autumn

Site	Bacillariophyceae			Chlorophyceae			Cryptophyceae			Cyanobacteria			Dinophyceae			Dictyochophyceae			
	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	W	S	A	
Permit area																			
SP1		7.17						0.14			91.68	91.67		1.00	8.33				
SP3	44.3	3.57	1.85							54.9	94.95	87.04	0.5	1.49	11.11	0.3			
SP5	28.2	2.67	25.00			50.00				70.8	95.99		0.5	1.34	25.00	0.5			
SP6	10.4	8.83	11.76							88.2	89.05	67.65	1.0	2.11	20.59	0.4			
Evans Shoal																			
SP7	27.3	5.86	4.26							70.3	92.90	82.98	1.8	1.23	12.77	0.6			
SP8		23.78	18.52								76.14	66.67		0.08	14.81				
SP10	20.1	2.10	12.50							78.6	96.50	43.75	1.0	1.40	43.75	0.3			
Tassie Shoal																			
SP11		15.27	46.67								82.00			2.73	53.33				
SP13		4.46	37.50								94.64			0.89	62.50				
SP14	92.3	4.00	12.50						0.2	12.50	6.1	94.57	0.9	1.23	75.00	0.7			
Lynedoch Bank																			
SP16		6.00							0.11		92.30	68.75		1.59	31.25				
SP17		18.37	11.63								71.43	72.09		10.20	16.28				

W – winter; S – summer; A – autumn

Table 3-22: Composition (%) of zooplankton at each site – winter

Phylum	Class	Permit area			Tassie Shoal SP14
		SP3	SP5	SP5	
Protista	Appendicularia	1.3	8.7	0.5	
	Foraminifera	1.3	0.4	1.9	
	Polycystinea			0.9	
	Gigartacantidae			0.9	
	Trizonidae	23.6	9.7	20.7	
	Unknown	0.6			
Crustacea	Copepoda	66.9	80.3	73.1	
	Malacostraca	1.9		0.5	
	Maxillopoda	0.6			
	Ostracoda	0.6			
	Sagittoidea	2.6	0.7	0.9	
Chaetognatha Echinodermata	Ophiuroidea		0.2	0.5	
	Thaliacea	0.6			

Table 3-23: Composition (%) of zooplankton at each site – summer

Phylum	Class	Permit area			Evans Shoal			Tassie Shoal			Lynedoch Bank	
		SP1	SP3	SP5	SP6	SP7	SP8	SP10	SP11	SP13	SP14	SP17
Protista	Foraminifera	1.07				0.87			3.85			2.90
	Polycystinea	0.27			8.20	1.74	1.60	66.92				
	Gigartacotidae					1.74	4.79		1.28			
	Spirotrichea								3.85			
	Trizonidae	62.13	56.55			71.30	75.53		34.62	74.86	75.20	33.33
Annelida	Unknown		0.69			1.74	0.53			0.18		
	Polychaeta		0.69				2.66					
	Branchiopoda	0.80	0.69		3.28							1.45
Crustacea	Cladocera	0.27										
	Copepoda	32.0	35.86	96.08	88.52	16.52	7.98	27.76	51.28	22.59	18.54	55.07
	Malacostraca									0.18		
	Maxillopoda									0.18		
	Gastropoda						2.61		1.28	0.36	0.52	
Mollusca	Sagittoidea	2.93	5.52	3.92		1.74	6.38	3.42	2.56	1.28	5.74	7.25
	Ophiuroidea					1.74	0.53	1.14		0.36		

Table 3-24: Composition (%) of zooplankton at each site – autumn

Phylum	Class	Permit area			Evans Shoal			Tassie Shoal			Lynedoch Bank		
		SP1	SP3	SP5	SP6	SP7	SP8	SP10	SP11	SP13	SP14	SP16	SP17
Protista	Foraminifera		0.09	0.07					0.84			0.74	
	Polycystinea									3.64	1.08	0.19	1.35
Annelida	Gigartacoitidae		98.06	70.32	63.07	9.18	8.42		81.84	82.89	7.53	93.60	87.58
	Unknown	0.49	0.06	0.29	0.57	0.51	1.32		0.08	5.70		0.08	0.31
	Polychaeta	3.44	0.03			13.78	5.53	0.42	0.08				
Arthropoda	Branchiopoda								0.08	0.10			
	Copepoda	93.12	1.35	28.29	19.32	69.90	81.58	95.34	17.10	7.57	88.17	1.24	7.25
Chaetognatha	Maxillopoda					2.55							
	Sagittoidea	0.25	0.13	0.43	3.98		0.26	2.54				0.50	
Urochordata	Appendicularia	2.70	0.28	0.61	13.07	4.08	2.89	1.69		0.10	3.23	3.65	3.52

4. Discussion

Three baseline water quality surveys were undertaken as part of the Barossa marine studies program with the aim of incorporating seasonality (winter, summer and a transition season (i.e. autumn)) into our understanding of marine water conditions in the permit area and broader surrounding area. In general, the sites surveyed ranged in depth from around 10 m–30 m on top of shoals and banks through to approximately 280 m in the permit area.

Dissolved oxygen was high in the surface water (90%–100% saturation at all sites and each season) decreasing to approximately 35% saturation in the bottom water of the deepest sites. The dissolved oxygen of the shallowest sites stayed constant from surface to bottom waters. Dissolved oxygen was highest near the ocean surface, where light for photosynthesis is strongest and oxygen exchange between the atmosphere and the ocean is at a maximum. Waves, wind and currents act to mix dissolved oxygen through the upper section of the water column. These processes become progressively weaker as depth increases. Below the upper mixed layer the oxygen content decreased with an increase in depth due to oxidation of organic matter resulting in the consumption of oxygen.

There was very little difference in salinity between the surface water and the bottom water at all sites during all seasons. Salinity at the surface waters were approximately 34 PSU, which was approximately 0.7 PSU lower than the bottom water of the deepest sites. As these sites were remote from any large land masses, the only potential factors affecting surface water salinity are climatic ones, i.e. precipitation or evaporation.

Surface water temperatures ranged from approximately 27°C in winter to approximately 30°C in summer and autumn, gradually decreasing with depth to approximately 11°C–13°C in the bottom water of the deepest sites. Other studies have shown that mean monthly temperatures in the central Timor Sea are typically between 26°C and 30°C decreasing to approximately 12°C at 300 m, with waters expected to be stratified all year round, but with the thermocline nearer the surface (50 m depth) in summer, compared to winter (100 m depth) (Woodside 1999). For those sites with sufficient depth, a thermocline was observed to occur with the depth changing between the surveys. The zone above the thermocline is called the 'mixed layer' in which horizontal and vertical mixing occurs and the zone below the thermocline is called the 'deep zone'. Stable temperature gradients act as barriers to vertical mixing and if wind-generated turbulence is insufficient to break down this gradient then no mixing will take place across the thermocline. The depth of the thermocline was similar in the winter and autumn surveys (occurring between approximately 70 m and 150 m) and deeper than the summer survey (present between 40 m and 70 m). This is thought to be due to strong, continual winds during winter and autumn, causing the depth of the mixed layer to be greater.

Turbidity was very low throughout the water column at each site and during each season (<0.2 NTU). Approximately 20 m–50 m (depending on the site) above the seabed the turbidity was slightly elevated and increased with depth, possibly caused by the action of currents passing over the seabed causing some turbulence and resuspension of sediments.

TSS concentrations were generally low (≤ 1 mg/L) or below laboratory detection limits at the sites sampled during winter and summer. No sampling of TSS was undertaken during the autumn survey.

The pH in the surface waters ranged from approximately 8.1–8.3 pH units while the pH at the seabed was ranged from approximately 7.7–7.9 pH units. The shape of the profiles for pH and dissolved oxygen were similar, with a decrease in pH occurring near the top of the thermocline, due to oxidation of organic matter. When dead organisms fall from the surface layers and start decaying they liberate carbon dioxide, which dissolves into the water producing carbonic acid that undergoes almost instantaneous ionisation into hydrogen ions and thus decreasing pH (Hinga 2002). Pressure and temperature also play a part as they affect the various equilibrium constants. In surface water, photosynthesis consumes carbon dioxide and therefore less dissociation of carbon dioxide into hydrogen ions occurs.

Chlorophyll a concentrations were low throughout the water column at each site and during each season, less than the ANZECC & ARMCANZ (2000b) trigger value of 0.9 µg/L. Chlorophyll a concentrations peaked at shallower depths during winter (30–50 m) and deeper depths during summer and autumn (50 m–70 m). During

summer the zone of maximum productivity lies some distance below the surface probably due to optimising the requirement for light and nutrients. Nutrient concentrations increase with depth and light penetration is greater in summer therefore the depth of maximum productivity would be greater in summer than winter.

Trichodesmium erythraeum (a blue-green alga) was the phytoplankton species captured in highest abundance at the majority of sites during each season. *Trichodesmium* spp. occur in large numbers in tropical areas of the Indian Ocean, where their ability to fix nitrogen enables them to thrive when nutrient concentrations are low (Riley and Chester 1971). Dinoflagellates were the most diverse group during the autumn survey, whereas diatoms were the most diverse group during the summer and winter surveys. The phytoplankton assemblage composition in autumn was similar to summer and winter, although silicoflagellates were only present during winter and cryptomonads were only present during summer and autumn.

Copepods were the most abundant zooplankton collected during each season. Copepods also displayed the highest species diversity whereas the majority of other Classes contained only one species.

Inorganic nutrients orthophosphate, ammonium and nitrite+nitrate are released when organic compounds decay. Nitrification is the term given to the oxidation process which converts ammonium (formed by the bacterial decay of marine organisms or excreted by marine animals) into nitrite and then nitrate. Oxygen is consumed during these processes, which was evident in the bottom water of the deepest sites in the permit area where phosphorus and nitrate concentrations were high and oxygen levels were low.

Metals are also released when organic materials decay. Although the metal concentrations analysed in samples collected during the surveys were very low, there were slight increases in arsenic, barium chromium and nickel in the bottom waters of the deepest sites at the permit area and Evans Shoal. The distribution of some metals in seawater have been reported to be significantly influenced by the uptake of phytoplankton in the surface waters, subsequent decomposition of the organic matter produced and remineralisation in deep waters (Abe 2004). There were no dissolved metal samples collected that exceeded the ANZECC & ARMCANZ (2000a) trigger values for 99% species protection except for the copper concentrations at four sites during winter and five sites during summer, which exceeded the ANZECC & ARMCANZ (2000a) trigger value of 0.3 µg/L.

TPHs/TRHs and BTEXN were below the laboratory reporting limits at all sites and depths for each season. The only exceptions to this were the presence of hydrocarbons at two sites in the permit area and one site at Evans Shoal during the winter survey, in which the TPH was above the LOR. However, it is thought that the concentration of hydrocarbons at these sites were due to small operational releases from the vessel, as areas of natural hydrocarbon seepage would be present in all fractions, not the fractions obtained during sampling. In addition, there was little difference in the hydrocarbon profiles between sites, which would also indicate a lack of natural hydrocarbon sources in the areas sampled. Therefore, overall, there was little difference in the hydrocarbon profiles between sites, which indicates a lack of hydrocarbons in the areas sampled.

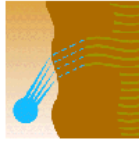
Radium²²⁶ and radium²²⁸ were above the minimum reporting limit at a number of sites during the three surveys, while thorium²²⁸ was not detected at any site. There are no ANZECC & ARMCANZ (2000a) trigger values associated with NORMs but there are guideline values for drinking water NHMRC & ARMCANZ (2011). Typical values for radium²²⁶ and radium²²⁸ in Australian drinking water supplies derived from groundwater sources, vary considerably depending on the aquifer and it is not uncommon in small supplies to find concentrations up to and exceeding 0.5 Bq/L. According to the guidelines, concentrations of radium²²⁶ should not be above 4.89 Bq/L and radium²²⁸ should not be above 1.98 Bq/L. All concentrations at all sites sampled during the three seasonal surveys were low (<0.49 Bq/L only slightly above the MRL of 0.10 Bq/L) and were lower than the threshold concentrations cited above.

In summary, the results of the three seasonal surveys (winter, summer and autumn) contribute to an appropriate baseline characterisation of the water quality in the study area.

5. References

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Appendix A. SBE 19plus V2 Calibration Certificate



SBE 19 Plus V2 - 600m (19P-7123) - Salinity, Temperature, DO, pH, Turbidity and PAR check

Client: Jacobs Group (Australia) Pty Ltd
Address: 263 Adelaide Terrace, Perth WA 6000
Contact: Celeste Wilson Email: Celeste.Wilson@jacobs.com

Analyst: K.Wienczugow
Date: 26/03/2015
Job: Conoco Phillips Barossa

Phone: 9469 4438

Table 1 Salinity Calibration Check

SBE 19 Plus V2 - 600m Serial No: 19P-7123	¹ Laboratory Salinity Check Water Salinity (psu ± 0.1)	² Laboratory SBE 19 Plus V2 Comparison Salinity (psu)	SBE 19 Plus V2 - 600m Salinity Reading (psu)	Tolerance ± 0.1psu Pass/Fail	Date Checked / Name
	32.7 ± 0.1	32.757	32.728	Pass	26/3/2015 K.Wienczugow

¹Laboratory salinity check water was prepared by calibrating against IAPSO standard seawater 35.00 psu. ²MAFRL's SBE 19 Plus V2 - 100m CTD was tested as an additional comparative measure.

Table 2 Temperature Calibration Check

SBE 19 Plus V2 - 600m Serial No: 19P-7123	³ Laboratory Temperature Check Temperature (± 0.1 °C)	² Laboratory SBE 19 Plus V2 Comparison Temperature (°C)	SBE 19 Plus V2 - 600m Temperature Reading (°C)	Tolerance ± 0.1°C Pass/Fail	Date Checked / Name
	22.7 ± 0.1	22.672	22.685	Pass	26/3/2015 K.Wienczugow

³Laboratory temperature check made with a NATA accredited -5.0 to 50.0°C immersion thermometer (Serial number: 0681667). ²MAFRL's SBE 19 Plus V2 - 100m CTD was tested as an additional comparative measure.

Table 3 pH Calibration Check

Model: SBE 18-I Serial Number:180946	⁴ Laboratory pH Check pH Standard (± 0.1)	SBE 19 Plus V2 - 600m pH Reading	Tolerance ± 0.1 pH Unit Pass/Fail	Date Calibrated / Name
	4.01 @ 25°C	3.99	Pass	26/3/2015 K.Wienczugow
	7.00 @ 25°C	7.03	Pass	26/3/2015 K.Wienczugow
	10.01 @ 25°C	9.99	Pass	26/3/2015 K.Wienczugow

⁴pH calibration performed with pH standards (opened 11/3/2015) according to Sea-Bird Application note 18-1 for pH sensor calibration (Slope = 4.6006, Offset = 2.5179)

Table 4 DO Calibration Check

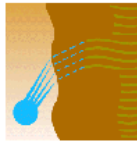
Model: SBE 43 Serial Number:432365	⁵ Laboratory SBE 19 Plus V2 Comparison Dissolved Oxygen (%)	SBE 19 Plus V2 - 600m Dissolved Oxygen Reading (%)	Tolerance ± 2% Pass/Fail	Date Checked / Name
	99.9	98.8	Pass	26/3/2015 K.Wienczugow
	80.4	79.1	Pass	26/3/2015 K.Wienczugow

⁵Dissolve Oxygen calibration check performed in air saturated water and in a reduced oxygen water environment and compared against cleaned calibrated SBE 43 DO sensor from MAFRL's SBE 19 Plus V2 - 100m CTD.

Signature: 
Date: 26/3/2015

*Please note this report is not covered by NATA accreditation

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SBE 19 Plus V2 - 600m (19P-7123) - Salinity, Temperature, DO, pH, Turbidity and PAR check

Client: Jacobs Group (Australia) Pty Ltd
Address: 263 Adelaide Terrace, Perth WA 6000
Contact: Celeste Wilson Email: Celeste.Wilson@jacobs.com

Analyst: K.Wienczugow
Date: 26/03/2015
Job: Conoco Phillips Barossa

Phone: 9469 4438

Table 5 Turbidity Calibration Check

Model: Wetlabs NTURT Serial Number: 201	⁶ Laboratory Turbidity Standard Turbidity (NTU ± 0.01)	⁷ SBE 19 Plus V2 - 600m Turbidity Reading (NTU)	Tolerance ± 5% Pass/Fail	Date Calibrated / Name
	0.0	0.04	Pass	26/3/2015 K.Wienczugow
	5.0	5.11	Pass	26/3/2015 K.Wienczugow
	10.0	9.97	Pass	26/3/2015 K.Wienczugow

⁶Zero NTU standard prepared from 0.2µm filtered deionised distilled water. Freshly prepared primary formazin standard 4000 NTU was diluted for a three point check carried out in a non reflective black plastic bucket.

⁷Average readings were calculated using Sea Save software and Wetlabs calibration coefficients optimised for maximum accuracy below 20 NTU (Scale factor = 6.000, Dark output = 0.096).

Table 4 PAR Calibration Check

Model: Satlantic PAR LOG-s Serial Number: 126	⁸ Laboratory Reference Lamp PAR (µmol s ⁻¹ m ⁻²)	⁹ SBE 19 Plus V2 - 600m PAR (µmol s ⁻¹ m ⁻²)	Tolerance ±5% Pass/Fail	Date Checked / Name
	267	255 ±13	Pass	26/3/2015 K.Wienczugow
	0 (dark)	0	Pass	26/3/2015 K.Wienczugow

⁸Quartz Tungsten Halogen Reference Lamp operated at 3150°K from a LI-1800-02 Optical Radiation Calibrator. Reference lamp output has been corrected for the immersion effect with a multiplier of 1.322 for in-water operation.

⁹A certified LICOR LI-192SA Underwater Quantum Sensor (Serial number: 8207) was used as a control to check the output of the tungsten reference lamp used for verifying PAR against the Satlantic PAR cosine log sensor.

Signatory:

Date: 26/3/2015

*Please note this report is not covered by NATA accreditation

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Appendix B. Plankton Transect Coordinates

Table B.1: GPS coordinates of the start and finish of the plankton transects – winter

Site name	Sample type	Coordinates (DDD° MM.MMM') ¹	
		Latitude	Longitude
SP3 start		9° 44' 55.592" S	130° 20' 31.955" E
SP3 finish	Phytoplankton and zooplankton	9° 45' 41.250" S	130° 10' 38.260" E
SP5 start		9° 53' 17.222" S	130° 24' 19.322" E
SP5 finish	Phytoplankton and zooplankton	9° 53' 16.390" S	130° 24' 09.370" E
SP6 start		9° 48' 44.030" S	129° 58' 5.259" E
SP6 finish	Phytoplankton and zooplankton	9° 48' 43.920" S	129° 57' 55.440" E
SP7 start		9° 55' 2.690" S	129° 33' 38.636" E
SP7 finish	Phytoplankton and zooplankton	9° 55' 02.170" S	129° 33' 28.950" E
SP10 start		9° 51' 25.533" S	129° 32' 5.302" E
SP10 finish	Phytoplankton and zooplankton	9° 51' 25.320" S	129° 31' 55.390" E
SP14 start		10° 14' 57.851" S	129° 46' 5.394" E
SP14 finish	Phytoplankton and zooplankton	10° 14' 52.570" S	129° 45' 58.170" E

Table B.2: GPS coordinates of the start and finish of the plankton transects – summer

Site name	Sample type	Coordinates (DDD° MM.MMM') ¹	
		Latitude	Longitude
SP1 start		9° 43' 30.000" S	130° 28' 54.300" E
SP1 finish	Phytoplankton and zooplankton	9° 43' 35.400" S	130° 29' 00.840" E
SP3 start		9° 45' 44.040" S	130° 10' 47.340" E
SP3 finish	Phytoplankton and zooplankton	9° 45' 47.760" S	130° 10' 56.520" E
SP5 start		9° 53' 19.320" S	130° 24' 21.300" E
SP5 finish	Phytoplankton and zooplankton	9° 53' 23.280" S	130° 24' 30.360" E
SP6 start		9° 48' 44.760" S	129° 58' 05.220" E
SP6 finish	Phytoplankton and zooplankton	9° 48' 50.520" S	129° 58' 13.200" E
SP7 start		9° 55' 06.720" S	129° 33' 37.920" E
SP7 finish	Phytoplankton and zooplankton	9° 55' 16.800" S	129° 33' 38.400" E
SP8 start		9° 57' 08.520" S	129° 32' 04.500" E
SP8 finish	Phytoplankton and zooplankton	9° 57' 13.560" S	129° 32' 13.380" E
SP10 start		9° 51' 39.600" S	129° 31' 51.840" E
SP10 finish	Phytoplankton and zooplankton	9° 51' 47.640" S	129° 31' 57.720" E
SP11 start		10° 08' 03.540" S	129° 32' 52.260" E
SP11 finish	Phytoplankton and zooplankton	10° 08' 06.180" S	129° 33' 01.440" E
SP13 start		10° 11' 40.680" S	129° 39' 42.960" E
SP13 finish	Phytoplankton and zooplankton	10° 11' 39.240" S	129° 39' 33.000" E
SP14 start		10° 14' 58.080" S	129° 46' 05.940" E
SP14 finish	Phytoplankton and zooplankton	10° 14' 48.420" S	129° 46' 03.600" E
SP16 start		10° 01' 37.120" S	130° 48' 36.420" E
SP16 finish	Phytoplankton and zooplankton	10° 01' 49.500" S	130° 48' 42.120" E
SP17 start		10° 02' 25.920" S	130° 50' 15.960" E
SP17 finish	Phytoplankton and zooplankton	10° 02' 31.680" S	130° 50' 24.120" E

Table B.3: GPS coordinates of the start and finish of the plankton transects – autumn

Site name	Sample type	Coordinates (DDD° MM.MMM') ¹	
		Latitude	Longitude
SP1 start		9° 43.999'S	130° 28.860'E
SP1 finish	Phytoplankton and zooplankton	9° 43.447'S	130° 28.706'E
SP3 start		9° 45.732'S	130° 10.800'E
SP3 finish	Phytoplankton and zooplankton	9° 45.729'S	130° 10.633'E
SP5 start		9° 53.289'S	130° 24.292'E
SP5 finish	Phytoplankton and zooplankton	9° 53.312'S	130° 24.129'E
SP6 start		9° 48.732'S	129° 57.923'E
SP6 finish	Phytoplankton and zooplankton	9° 48.726'S	129° 57.922'E
SP7 start		9° 55.061'S	129° 33.670'E
SP7 finish	Phytoplankton and zooplankton	9° 54.922'S	129° 33.580'E
SP8 start		9° 57.132'S	129° 32.098'E
SP8 finish	Phytoplankton and zooplankton	9° 57.135'S	129° 31.929'E
SP10 start		9° 51.430'S	129° 32.085'E
SP10 finish	Phytoplankton and zooplankton	9° 51.505'S	129° 31.935'E
SP11 start		10° 07.995'S	129° 33.000'E
SP11 finish	Phytoplankton and zooplankton	10° 08.025'S	129° 32.840'E
SP13 start		10° 11.727'S	129° 39.762'E
SP13 finish	Phytoplankton and zooplankton	10° 11.563'S	129° 39.759'E
SP14 start		10° 14.964'S	129° 46.090'E
SP14 finish	Phytoplankton and zooplankton	10° 14.870'S	129° 45.951'E
SP16 start		10° 01.636'S	130° 48.579'E
SP16 finish	Phytoplankton and zooplankton	10° 01.587'S	130° 48.417'E
SP17 start		10° 02.433' S	130° 50.267'E
SP17 finish	Phytoplankton and zooplankton	10° 02.428' S	130° 50.101'E

¹ Datum = GDA94.

Appendix C. Analytical Laboratory Reports

Appendix C1. Winter



Environmental

CERTIFICATE OF ANALYSIS

Work Order : **EP1404964** Page : 1 of 10

Client : **JACOBS GROUP (AUSTRALIA) PTY LTD** Laboratory : Environmental Division Perth

Contact : **CELESTE WILSON** Contact : **Scott James**

Address : **P O BOX H615** Address : **10 Hod Way Malaga WA Australia 6090**

E-mail : **perth.enviro.services@alsglobal.com**

Telephone : **+61 8 9469 4400** Telephone : **+61-8-9209 7655**

Facsimile : **+61 8 9469 4488** Facsimile : **+61-8-9209 7600**

Project : **Jacobs Project Number WV04831 104** QC Level : **NEPM 2013 Schedule B(3) and ALS QCS3 requirement**

Order number : **----**

C-O-C number : **----**

Sampler : **G.C.**

Site : **----**

Quote number : **EP/370/14**

Date Samples Received : **01-JUL-2014**

Issue Date : **08-JUL-2014**

No. of samples received : **36**

No. of samples analysed : **34**

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

WORLD RECOGNISED
ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Agnes Szilagyi	Senior Organic Chemist	Perth Organics



Page : 2 of 10
Work Order : EP1404964
Client : JACOBS GROUP (AUSTRALIA) PTY LTD
Project : Jacobs Project Number WV04831 104

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)	Client sample ID		SP2-B	SP3-S	SP3-M	SP3-B	SP4-S		
Compound	CAS Number	LOR	Client sampling date / time	Unit	SP2-B	SP3-S	SP3-M	SP3-B	SP4-S
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20		µg/L	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50		µg/L	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100		µg/L	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50		µg/L	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50		µg/L	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	20		µg/L	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20		µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100		µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100		µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100		µg/L	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100		µg/L	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100		µg/L	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1		µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2		µg/L	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2		µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2		µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2		µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2		µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1		µg/L	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5		µg/L	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1		%	88.1	98.8	108	102	105
Toluene-D8	2037-26-5	0.1		%	110	105	104	105	104
4-Bromofluorobenzene	460-00-4	0.1		%	83.6	86.0	88.6	87.1	87.9



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP4-M	SP4-B	SP5-S	SP5-M	SP5-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	<100	<100	140	<100	<100	<100	<100
C29 - C36 Fraction	----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	<50	<50	140	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	130	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	130	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	84.0	100	104	84.1	113	113	113
Toluene-D8	2037-26-5	0.1	113	106	104	112	106	106	106
4-Bromofluorobenzene	460-00-4	0.1	81.0	86.5	88.6	80.1	89.8	89.8	89.8



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP6-S	SP6-M	SP6-B	SP7-S	SP7-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20			<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50			<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100			<100	310	<100	<100	<100
C29 - C36 Fraction	-----	50			<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50			<50	310	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	20			<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20			<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100			<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100			<100	230	<100	<100	<100
>C34 - C40 Fraction	----	100			<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100			<100	230	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100			<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1			<1	<1	<1	<1	<1
Toluene	108-88-3	2			<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2			<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2			<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2			<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2			<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1			<1	<1	<1	<1	<1
Naphthalene	91-20-3	5			<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1		%	81.8	81.2	104	103	102
Toluene-D8	2037-26-5	0.1		%	114	115	108	106	106
4-Bromofluorobenzene	460-00-4	0.1		%	81.2	81.6	88.4	87.9	87.8



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID	
Compound	CAS Number	Client sampling date / time	Unit
	LOR		
EP080/071: Total Petroleum Hydrocarbons			
C6 - C9 Fraction	----	<20	µg/L
C10 - C14 Fraction	----	<50	µg/L
C15 - C28 Fraction	----	<100	µg/L
C29 - C36 Fraction	----	<50	µg/L
^ C10 - C36 Fraction (sum)	----	<50	µg/L
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013			
C6 - C10 Fraction	C6_C10	<20	µg/L
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	<20	µg/L
>C10 - C16 Fraction	>C10_C16	<100	µg/L
>C16 - C34 Fraction	----	<100	µg/L
>C34 - C40 Fraction	----	<100	µg/L
^ >C10 - C40 Fraction (sum)	----	<100	µg/L
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	<100	µg/L
EP080: BTEXN			
Benzene	71-43-2	<1	µg/L
Toluene	108-88-3	<2	µg/L
Ethylbenzene	100-41-4	<2	µg/L
meta- & para-Xylene	108-38-3 106-42-3	<2	µg/L
ortho-Xylene	95-47-6	<2	µg/L
^ Total Xylenes	1330-20-7	<2	µg/L
^ Sum of BTEX	----	<1	µg/L
Naphthalene	91-20-3	<5	µg/L
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	0.1	%
Toluene-D8	2037-26-5	0.1	%
4-Bromofluorobenzene	460-00-4	0.1	%

SP10-S	SP10-M	SP10-B	SP11-S	SP11-B
29-JUN-2014 15:00 EP1404964-021	29-JUN-2014 15:00 EP1404964-022	29-JUN-2014 15:00 EP1404964-023	29-JUN-2014 08:15 EP1404964-024	29-JUN-2014 08:15 EP1404964-025
<20	<20	<20	<20	<20
<50	<50	<50	<50	<50
<100	<100	<100	<100	<100
<50	<50	<50	<50	<50
<50	<50	<50	<50	<50
<20	<20	<20	<20	<20
<20	<20	<20	<20	<20
<100	<100	<100	<100	<100
<100	<100	<100	<100	<100
<100	<100	<100	<100	<100
<100	<100	<100	<100	<100
<1	<1	<1	<1	<1
<2	<2	<2	<2	<2
<2	<2	<2	<2	<2
<2	<2	<2	<2	<2
<1	<1	<1	<1	<1
<5	<5	<5	<5	<5
93.8	83.2	78.2	78.9	81.6
110	113	113	116	113
85.8	76.7	79.5	78.2	75.9



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP12-S	SP12-M	SP12-B	SP13-S	SP13-M
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20			<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50			<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100			<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50			<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50			<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013									
C6 - C10 Fraction	C6_C10	20			<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20			<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100			<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100			<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100			<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100			<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100			<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1			<1	<1	<1	<1	<1
Toluene	108-88-3	2			<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2			<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2			<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2			<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2			<2	<2	<2	<2	<2
^ Sum of BTEX	----	1			<1	<1	<1	<1	<1
Naphthalene	91-20-3	5			<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1		%	105	104	101	102	92.8
Toluene-D8	2037-26-5	0.1		%	106	105	108	105	109
4-Bromofluorobenzene	460-00-4	0.1		%	86.1	87.8	87.5	86.2	81.9



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

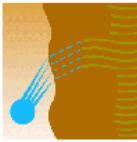
Compound	CAS Number	LOR	Unit	Client sample ID			
				Client sampling date / time	SP13-B	SP14-S	SP14-M
EP080/071: Total Petroleum Hydrocarbons							
C6 - C9 Fraction		20	µg/L	<20	<20	<20	<20
C10 - C14 Fraction		50	µg/L	<50	<50	<50	<50
C15 - C28 Fraction		100	µg/L	<100	<100	<100	<100
C29 - C36 Fraction		50	µg/L	<50	190	190	<50
^ C10 - C36 Fraction (sum)		50	µg/L	<50	190	190	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013							
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	<100	<100
>C16 - C34 Fraction		100	µg/L	<100	180	180	<100
>C34 - C40 Fraction		100	µg/L	<100	220	220	<100
^ >C10 - C40 Fraction (sum)		100	µg/L	<100	400	400	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)		100	µg/L	<100	<100	<100	<100
EP080: BTEXN							
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	<2
^ Sum of BTEX		1	µg/L	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates							
1,2-Dichloroethane-D4	17060-07-0	0.1	%	103	82.2	123	113
Toluene-D8	2037-26-5	0.1	%	107	114	105	102
4-Bromofluorobenzene	460-00-4	0.1	%	87.6	79.0	89.4	89.7



Page : 10 of 10
Work Order : EP1404964
Client : JACOBS GROUP (AUSTRALIA) PTY LTD
Project : Jacobs Project Number WV04831 104

Surrogate Control Limits

Sub-Matrix: WATER			
Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP080S: TPH(V)/BTX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	60.5	141.2
Toluene-D8	2037-26-5	73.4	126
4-Bromofluorobenzene	460-00-4	59.6	125.3



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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 15/07/2014
Date Received: 01/07/2014
Our Reference: SKM14-24 - 2
Your Reference: WV04831.104

WATER QUALITY DATA

METHOD	Sampling Date	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	3000 CHLOROPHYLL'a' µg/L	3000 PHAEOPHYTIN'a' µg/L	2540D TSS mg/L
Reporting Limit		<3	<2	<2	<5	<50	<0.05	<0.2	<1
File		14070202,0203				14070401	14070801		140703
SP1S	28/06/2014	<3	5	5	15	90	0.36	<0.2	
SP1M	28/06/2014	<3	33	250	38	300	<0.05	<0.2	
SP1B	28/06/2014	<3	60	390	65	440	<0.05	<0.2	
SP2S	28/06/2014	5	5	120	15	220	0.43	<0.2	<0.5
SP2M	28/06/2014	<3	34	250	39	310	<0.05	<0.2	
SP2B	28/06/2014	<3	61	400	65	430	<0.05	<0.2	
SP3S	29/06/2014	<3	5	15	15	110	0.50	<0.2	<0.5
SP3M	29/06/2014	<3	35	240	41	280	<0.05	<0.2	
SP3B	29/06/2014	<3	59	380	64	420	<0.05	<0.2	
SP4S	29/06/2014	<3	5	5	14	90	0.21	<0.2	
SP4M	29/06/2014	<3	28	180	34	240	0.07	<0.2	
SP4B	29/06/2014	<3	54	350	57	380	<0.05	<0.2	
SP5S	28/06/2014	<3	4	4	13	80	0.41	<0.2	
SP5M	28/06/2014	<3	26	170	31	220	0.08	<0.2	
SP5B	28/06/2014	<3	52	350	55	390	<0.05	<0.2	
SP6S	29/06/2014	<3	5	6	14	90	0.16	<0.2	<0.5
SP6M	29/06/2014	<3	34	220	38	270	<0.05	<0.2	
SP6B	29/06/2014	3	60	390	64	440	<0.05	<0.2	
SP7S	29/06/2014	<3	5	3	13	80	0.22	<0.2	
SP7B	29/06/2014	6	6	6	14	80	0.45	<0.2	

Signatory: Jamie Woodward
Date: 15/07/2014

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WATER QUALITY DATA

METHOD	Sampling Date	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	3000 CHLOROPHYLL'a µg/L	3000 PHAEOPHYTIN'a µg/L	2540D TSS mg/L
Reporting Limit		<3	<2	<2	<5	<50	<0.05	<0.2	<1
File		14070202,0203				14070401	14070801	140703	
SP10S	29/06/2014	<3	5	6	14	100	0.18	<0.2	
SP10M	29/06/2014	<3	31	200	36	260	0.05	<0.2	
SP10B	29/06/2014	<3	51	330	54	370	<0.05	<0.2	
SP11S	29/06/2014	<3	4	<2	14	90	0.21	<0.2	
SP11B	29/06/2014	7	4	6	14	110	0.35	<0.2	
SP12S	29/06/2014	<3	4	2	14	90	0.17	<0.2	<0.5
SP12M	29/06/2014	<3	4	<2	12	90	0.42	<0.2	
SP12B	29/06/2014	<3	29	180	34	240	0.07	<0.2	
SP13S	29/06/2014	<3	5	<2	14	100	0.16	<0.2	
SP13M	29/06/2014	<3	4	4	12	100	0.53	<0.2	
SP13B	29/06/2014	<3	24	150	30	220	0.10	<0.2	
SP14S	26/06/2014	7	4	3	13	100	0.34	<0.2	
SP14M	26/06/2014	4	3	2	14	120	0.33	<0.2	
SP14B	26/06/2014	3	23	140	29	230	0.07	<0.2	
Transport Blank		<3	<2	<2	<5	<50			
Field Blank		9	<2	8	<5	<50	<0.05	<0.2	

Signatory: Jamie Woodward
Date: 15/07/2014

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WATER QUALITY DATA

Date of Issue: 15/07/2014
Date Received: 01/07/2014
Our Reference: SKM14-24 - 2
Your Reference: WV04831.104

METHOD SAMPLE CODE	Sampling Date	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	ICP006 Hg mg/L	
Reporting Limit		<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	
14070401-02												
SP1S	28/06/2014	<0.2	<0.05	<0.3	0.4	1	1.7	<0.1	5.4	<0.1	<0.0001	
SP1M	28/06/2014	0.2	<0.05	<0.3	<0.2	1	1.9	<0.1	5.6	<0.1	<0.0001	
SP1B	28/06/2014	0.2	<0.05	0.4	<0.2	<1	1.9	<0.1	8.0	<0.1	<0.0001	
SP2S	28/06/2014	<0.2	<0.05	<0.3	0.3	3	1.7	<0.1	5.6	<0.1	<0.0001	
SP2M	28/06/2014	0.2	<0.05	0.3	0.4	3	1.9	<0.1	5.5	<0.1	<0.0001	
SP2B	28/06/2014	0.2	<0.05	0.4	<0.2	1	1.9	<0.1	7.5	<0.1	<0.0001	
SP3S	29/06/2014	<0.2	<0.05	<0.3	0.2	2	1.7	<0.1	5.3	<0.1	<0.0001	
SP3M	29/06/2014	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.5	<0.1	<0.0001	
SP3B	29/06/2014	0.2	<0.05	0.3	<0.2	1	1.8	<0.1	7.5	<0.1	<0.0001	
SP4S	29/06/2014	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.6	<0.1	<0.0001	
SP4M	29/06/2014	<0.2	<0.05	0.3	0.2	<1	1.7	<0.1	5.6	<0.1	<0.0001	
SP4B	29/06/2014	0.2	<0.05	0.3	<0.2	<1	1.8	<0.1	7.0	<0.1	<0.0001	
SP5S	28/06/2014	<0.2	<0.05	<0.3	0.5	3	1.7	<0.1	5.3	0.1	<0.0001	
SP5M	28/06/2014	0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001	
SP5B	28/06/2014	0.2	<0.05	0.3	0.2	1	1.8	<0.1	6.7	<0.1	<0.0001	
SP6S	29/06/2014	<0.2	<0.05	<0.3	0.3	1	1.6	<0.1	5.4	<0.1	<0.0001	
SP6M	29/06/2014	<0.2	<0.05	<0.3	0.2	<1	1.8	<0.1	5.5	<0.1	<0.0001	
SP6B	29/06/2014	0.2	<0.05	0.4	0.3	2	1.8	<0.1	7.6	<0.1	<0.0001	
SP7S	29/06/2014	<0.2	<0.05	<0.3	0.3	2	1.6	<0.1	5.6	<0.1	<0.0001	
SP7B	29/06/2014	<0.2	<0.05	0.3	0.4	2	1.5	<0.1	5.4	<0.1	<0.0001	

Jamie Woodward

Signatory: Jamie Woodward
Date: 15/07/2014

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WATER QUALITY DATA

Date of Issue: 15/07/2014
Date Received: 01/07/2014
Our Reference: SKM14-24 - 2
Your Reference: WV04831.104

METHOD SAMPLE CODE	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	ICP006 Hg mg/L
Reporting Limit	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001
File	14070401-02									
SP10S	<0.2	<0.05	<0.3	0.3	<1	1.7	<0.1	5.4	<0.1	<0.0001
SP10M	<0.2	<0.05	0.3	0.4	2	1.7	<0.1	5.8	<0.1	<0.0001
SP10B	0.2	<0.05	0.3	0.3	1	1.8	<0.1	6.8	<0.1	<0.0001
SP11S	<0.2	<0.05	<0.3	0.4	1	1.6	<0.1	5.6	<0.1	<0.0001
SP11B	<0.2	<0.05	<0.3	0.3	3	1.6	<0.1	5.4	<0.1	<0.0001
SP12S	<0.2	<0.05	<0.3	0.2	1	1.6	<0.1	5.5	<0.1	<0.0001
SP12M	<0.2	<0.05	<0.3	0.3	<1	1.6	<0.1	5.4	<0.1	<0.0001
SP12B	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	6.1	<0.1	<0.0001
SP13S	<0.2	<0.05	<0.3	0.3	1	1.6	<0.1	5.6	<0.1	<0.0001
SP13M	<0.2	<0.05	<0.3	0.3	1	1.6	<0.1	5.3	<0.1	<0.0001
SP13B	<0.2	<0.05	<0.3	<0.2	1	1.8	<0.1	6.0	<0.1	<0.0001
SP14S	<0.2	<0.05	<0.3	<0.2	2	1.7	<0.1	5.3	<0.1	<0.0001
SP14M	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.2	<0.1	<0.0001
SP14B	<0.2	<0.05	<0.3	0.4	3	1.7	<0.1	6.0	<0.1	<0.0001
Transport Blank	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001
Field Blank	<0.2	<0.05	<0.3	<0.2	1	<0.5	<0.1	<0.5	<0.1	<0.0001

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Date: 15/07/2014

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**Marine and Freshwater
Research Laboratory
Environmental Science**

Tel: +61 8 93602907 Address: 90 South St, Murdoch, WA, 6150



Accreditation Number: 10603
Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or
measurements included in this document are
traceable to Australian/national standards.



Contact: Celeste Wilson
Customer: Jacobs

Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of issue: 15/07/2014
Date Received: 01/07/2014
Our Reference: SKM14-24 - 2
Your Reference: WV04831.104

WATER QUALITY DATA

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	MS001 Unfiltered Hg mg/L	ICP006
Reporting Limit		<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001
SP1S	28/06/2014	<0.2	<0.05	<0.3	0.3	1	1.8	<0.1	5.6	<0.1	<0.0001	<0.0001
SP1M	28/06/2014	0.2	<0.05	0.4	<0.2	1	1.9	<0.1	5.6	<0.1	<0.0001	<0.0001
SP1B	28/06/2014	0.3	<0.05	0.4	<0.2	<1	2.0	<0.1	7.9	<0.1	<0.0001	<0.0001
SP2S	28/06/2014	<0.2	<0.05	<0.3	0.5	3	1.7	<0.1	5.5	<0.1	<0.0001	<0.0001
SP2M	28/06/2014	0.2	<0.05	0.3	1.0	4	1.9	<0.1	5.7	<0.1	<0.0001	<0.0001
SP2B	28/06/2014	0.3	<0.05	0.4	<0.2	<1	1.9	<0.1	7.8	<0.1	<0.0001	<0.0001
SP3S	29/06/2014	<0.2	<0.05	<0.3	0.2	2	1.7	<0.1	5.3	<0.1	<0.0001	<0.0001
SP3M	29/06/2014	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.5	<0.1	<0.0001	<0.0001
SP3B	29/06/2014	0.3	<0.05	0.3	<0.2	1	1.8	<0.1	7.5	<0.1	<0.0001	<0.0001
SP4S	29/06/2014	<0.2	<0.05	<0.3	0.2	1	1.6	<0.1	5.5	<0.1	<0.0001	<0.0001
SP4M	29/06/2014	0.2	<0.05	<0.3	0.2	<1	1.8	<0.1	5.7	<0.1	<0.0001	<0.0001
SP4B	29/06/2014	0.2	<0.05	0.4	0.2	<1	1.9	<0.1	6.9	<0.1	<0.0001	<0.0001
SP5S	28/06/2014	<0.2	<0.05	<0.3	0.3	2	1.7	<0.1	5.3	<0.1	<0.0001	<0.0001
SP5M	28/06/2014	0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.5	<0.1	<0.0001	<0.0001
SP5B	28/06/2014	0.2	<0.05	0.4	0.4	2	1.7	<0.1	6.8	<0.1	<0.0001	<0.0001
SP6S	29/06/2014	<0.2	<0.05	<0.3	0.4	2	1.6	<0.1	5.5	<0.1	<0.0001	<0.0001
SP6M	29/06/2014	<0.2	<0.05	0.3	0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001	<0.0001
SP6B	29/06/2014	0.2	<0.05	0.4	0.2	1	1.9	<0.1	7.7	<0.1	<0.0001	<0.0001
SP7S	29/06/2014	<0.2	<0.05	<0.3	0.3	1	1.7	<0.1	5.6	<0.1	<0.0001	<0.0001
SP7B	29/06/2014	<0.2	<0.05	0.3	0.5	2	1.7	<0.1	5.5	<0.1	<0.0001	<0.0001

14070901-02

Signatory: Jamie Woodward
Date: 15/07/2014

All test items tested as received. Spare test items will be held for two months unless otherwise requested.

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Contact: Celeste Wilson
Customer: Jacobs

Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 15/07/2014
Date Received: 01/07/2014
Our Reference: SKM14-24 - 2
Your Reference: WV04831.104

WATER QUALITY DATA

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	MS001 Unfiltered Hg mg/L	ICP006
Reporting Limit		<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	
File												14070901-02
SP10S	29/06/2014	<0.2	<0.05	<0.3	0.3	<1	1.6	<0.1	5.5	<0.1	<0.0001	<0.0001
SP10M	29/06/2014	0.2	<0.05	0.3	0.4	2	1.8	<0.1	5.8	<0.1	<0.0001	<0.0001
SP10B	29/06/2014	0.2	<0.05	0.4	0.4	2	1.8	<0.1	6.7	<0.1	<0.0001	<0.0001
SP11S	29/06/2014	<0.2	<0.05	<0.3	0.3	<1	1.6	<0.1	5.9	<0.1	<0.0001	<0.0001
SP11B	29/06/2014	<0.2	<0.05	<0.3	0.3	1	1.6	<0.1	5.5	<0.1	<0.0001	<0.0001
SP12S	29/06/2014	<0.2	<0.05	<0.3	0.2	<1	1.6	<0.1	5.4	<0.1	<0.0001	<0.0001
SP12M	29/06/2014	<0.2	<0.05	<0.3	0.3	<1	1.6	<0.1	5.5	<0.1	<0.0001	<0.0001
SP12B	29/06/2014	0.2	<0.05	<0.3	0.2	<1	1.7	<0.1	6.0	<0.1	<0.0001	<0.0001
SP13S	29/06/2014	<0.2	<0.05	<0.3	0.3	1	1.6	<0.1	5.5	<0.1	<0.0001	<0.0001
SP13M	29/06/2014	<0.2	<0.05	<0.3	0.4	1	1.6	<0.1	5.5	<0.1	<0.0001	<0.0001
SP13B	29/06/2014	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.9	<0.1	<0.0001	<0.0001
SP14S	26/06/2014	<0.2	<0.05	<0.3	0.2	2	1.7	<0.1	5.4	<0.1	<0.0001	<0.0001
SP14M	26/06/2014	<0.2	<0.05	<0.3	0.2	2	1.7	<0.1	5.5	<0.1	<0.0001	<0.0001
SP14B	26/06/2014	<0.2	<0.05	<0.3	0.4	4	1.8	<0.1	6.1	<0.1	<0.0001	<0.0001
Transport Blank		<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001
Field Blank		<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001

Signatory: Jamie Woodward
Date: 15/07/2014

All test items tested as received. Spare test items will be held for two months unless otherwise requested.

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Accredited Laboratory
No. 14174

15 August 2014

Ref: 7956
Contract: PB 22767
Page 1 of 3

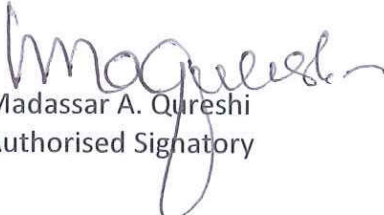
Sinclair Knight Merz – JACOBS PROJECT
7th Floor Durack Centre
PERTH WA 6000

Attn: Celeste Wilson

ANALYTICAL REPORT

The results (to 95%, 2σ confidence level) for Radium-226, Radium-228 and Thorium-228 analyses of thirty four (34) liquid samples, as received at our laboratory on 11 July 2014, are detailed on page two and three of this report.

MDL:	Radium-226	0.100Bq/l	Radium-228	0.100Bq/l
	Thorium-228	0.100Bq/l		
Method:	LTP No. 4(a)	Gamma Spectrometry Analysis		


Madassar A. Qureshi
Authorised Signatory

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WRS No	Client Sample ID	Ra-226 (Bq/l)	Ra-228 (Bq/l)	Th-228 (Bq/l)
7956-1	SP1-S 28/06/2014	<MDL	0.123 ± 0.061	<MDL
7956-2	SP1-M 28/06/2014	<MDL	<MDL	<MDL
7956-3	SP1-B 28/06/2014	<MDL	<MDL	<MDL
7956-4	SP2-S 28/06/2014	<MDL	<MDL	<MDL
7956-5	SP2-M 28/06/2014	<MDL	0.493 ± 0.176	<MDL
7956-6	SP2-B 28/06/2014	<MDL	0.297 ± 0.103	<MDL
7956-7	SP3-S 29/06/2014	<MDL	0.230 ± 0.068	<MDL
7956-8	SP3-M 29/06/2014	<MDL	<MDL	<MDL
7956-9	SP3-B 29/06/2014	<MDL	<MDL	<MDL
7956-10	SP4-S 29/06/2014	<MDL	<MDL	<MDL
7956-10D	SP4-S 29/06/2014	<MDL	<MDL	<MDL
7956-11	SP4-M 29/06/2014	0.175 ± 0.068	0.110 ± 0.050	<MDL
7956-12	SP4-B 29/06/2014	<MDL	<MDL	<MDL
7956-13	SP5-S 28/06/2014	<MDL	0.257 ± 0.040	<MDL
7956-14	SP5-M 28/06/2014	<MDL	<MDL	<MDL
7956-15	SP5-B 28/06/2014	<MDL	<MDL	<MDL
7956-16	SP6-S 29/06/2014	<MDL	0.157 ± 0.044	<MDL
7956-17	SP6-M 29/06/2014	<MDL	<MDL	<MDL
7956-18	SP6-B 29/06/2014	<MDL	<MDL	<MDL
7956-19	SP7-S 29/06/2014	<MDL	<MDL	<MDL
7956-20	SP7-B 29/06/2014	<MDL	<MDL	<MDL
7956-20D	SP7-B 29/06/2014	<MDL	<MDL	<MDL
7956-21	SP10-S 29/06/2014	<MDL	<MDL	<MDL
7956-22	SP10-M 29/06/2014	<MDL	<MDL	<MDL
7956-23	SP10-B 29/06/2014	<MDL	<MDL	<MDL

Ref:7956
Page 2 of 3



WRS No	Client Sample ID	Ra-226 (Bq/l)	Ra-228 (Bq/l)	Th-228 (Bq/l)
7956-24	SP11-S 29/06/2014	<MDL	<MDL	<MDL
7956-25	SP11-B 29/06/2014	<MDL	<MDL	<MDL
7956-26	SP12-S 29/06/2014	<MDL	<MDL	<MDL
7956-27	SP12-M 29/06/2014	<MDL	<MDL	<MDL
7956-28	SP12-B 29/06/2014	<MDL	<MDL	<MDL
7956-29	SP13-S 29/06/2014	<MDL	<MDL	<MDL
7956-30	SP13-M 29/06/2014	<MDL	<MDL	<MDL
7956-30D	SP13-M 29/06/2014	<MDL	<MDL	<MDL
7956-31	SP13-B 29/06/2014	<MDL	<MDL	<MDL
7956-32	SP14-S 26/06/2014	<MDL	<MDL	<MDL
7956-33	SP14-M 26/06/2014	<MDL	<MDL	<MDL
7956-34	SP14-B 26/06/2014	<MDL	0.249 ± 0.097	<MDL

The reported expanded uncertainty of measurement is stated as the standard uncertainty of the measurement ± 5.6 %, multiplied by the coverage factor k=2, which corresponds to a coverage probability of approximately 95%.

Ref:7956
Page 3 of 3

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 12/08/2014	DSID 24338
Batch Number 140702111432	Sample ID SP3	Date Collected 29/06/2014	
Monitoring Point SP3	Sample Type Phytoplankton	Date Received 2/07/2014	
Functional Location ID SP3	Method (Detection Limit) Raw Count (1)	Analysis Date 12/08/2014	
Units Reported	Cell Density: Cells ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted

Sampler Notes

Laboratory Notes

Concentrated (phytoplankton net) sample.
Qualitative analysis.
Sedgewick Rafter Chamber (1 ml) - 1 Long transect analysed.

Field Data Recording

Total Density	Cells ⁻¹	Total Counted	Uncertainty
743.0		743	7.3%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Asterolampra sp. 002		2	0.27
Chaetoceros spp.		131	17.63
Coscinodiscus nitidis		1	0.13
Coscinodiscus sp. 002		1	0.13
Cylindrotheca closterium		76	10.23
Detonula sp. 001		4	0.54
Fragilariopsis kergulensis		14	1.88
Guinardia striata		3	0.40
Leptocylindrus danicus		5	0.67
Leptocylindrus minimus		4	0.54
Navicula spp.		3	0.40
Nitzschia longissima		14	1.88
Nitzschia spp.		12	1.62
Planktoniella sol		1	0.13
Pseudonitzschia delicatissima group		9	1.21
Pseudonitzschia seriata group		1	0.13
Rhizosolenia spp.		1	0.13
Thalassiosira pseudonana		11	1.48
Thalassiosira sp. 004		26	3.50
Thalassiothrix sp. 001		10	1.35
		329	0.000
			44.28

Species Name	Density	BioVolume	%
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	408		54.91
	408	0.0000	54.91
<i>Dictyochophyceae</i>			
Dictyocha fibula var. rhombica	1		0.13
Dictyocha octonaria	1		0.13
	2	0.0000	0.27
<i>Dinophyceae</i>			
Ceratium spp.	1		0.13
Prorocentrum dentatum	2		0.27
Scrippsiella trochoidea	1		0.13
	4	0.0000	0.54

End Of Report

This report contains coloured shading. Dalcon Environmental intends that this report be viewed and/or printed in colour.

Dalcon Environmental Pty Ltd makes no claim that the taxa list provided herein is exhaustive. Some taxa, including potentially problematic taxa, may be present in the sample but not recorded during analysis, this is particularly the case for small or inconspicuous taxa or taxa present in low numbers. Guidance presented herein is based on published research, whilst Dalcon Environmental make every attempt to remain up to date, it is possible that scientific consensus may differ from that presented herein.

Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 12/08/2014	DSID 24339
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Batch Number 140702111615	Sample ID SP5	Date Collected 28/06/2014
Monitoring Point SP5	Sample Type Phytoplankton	Date Received 2/07/2014
Functional Location ID SP5	Method (Detection Limit) Raw Count (1)	Analysis Date 12/08/2014
Units Reported	Cell Density: Cells ⁻¹	Biovolume: mm ³ L ⁻¹
		%: Percentage of total cells counted

Sampler Notes

Laboratory Notes

Concentrated (phytoplankton net) sample.
Qualitative analysis.
Sedgewick Rafter Chamber (1 ml) - 1 Long transect analysed.

Field Data Recording

Total Density	Cells ⁻¹	Total Counted	Uncertainty
1,243.0		1,243	5.7%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Asterolampra sp. 001		1	0.08
Asterolampra sp. 002		1	0.08
Bacteriastrium hyalinum		10	0.80
Cerataulina sp. 004		9	0.72
Chaetoceros spp.		114	9.17
Climacodium frauenfeldianum		4	0.32
Coscinodiscus nitidis		5	0.40
Cylindrotheca closterium		88	7.08
Diatom 189		1	0.08
Eucampia cornuta		4	0.32
Fragilariopsis kergulensis		3	0.24
Navicula spp.		3	0.24
Nitzschia longissima		30	2.41
Nitzschia spp.		2	0.16
Pseudonitzschia delicatissima group		14	1.13
Pseudonitzschia seriata group		8	0.64
Rhizosolenia setigera		7	0.56
Rhizosolenia spp.		5	0.40
Thalassionema frauenfeldii		12	0.97
Thalassiosira pseudonana		7	0.56
Thalassiosira sp. 004		7	0.56

Species Name	Density	BioVolume	%
Thalassiothrix sp. 001	15		1.21
	350	0.0000	28.16
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	880		70.80
	880	0.0000	70.80
<i>Dictyochophyceae</i>			
Dictyocha fibula var. rhombica	6		0.48
	6	0.0000	0.48
<i>Dinophyceae</i>			
Ceratium breve	2		0.16
Ornithocercus splendidus	3		0.24
Protoperidinium roseum	1		0.08
Protoperidinium sp. 037	1		0.08
	7	0.0000	0.56

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart	DSID 24340
Batch Number 140702111733	Sample ID SP6	Date Collected 29/06/2014	
Monitoring Point SP6 - Barossa WV04831	Sample Type Phytoplankton	Date Received 2/07/2014	
Functional Location ID SP6	Method (Detection Limit) Raw Count (1)	Analysis Date 12/08/2014	
Units Reported	Cell Density:Cells ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted

Sampler Notes

Laboratory Notes

Concentrated (phytoplankton net) sample.
Qualitative analysis.
Sedgewick Rafter Chamber (1 ml) - 1 Long transect analysed.

Field Data Recording

Total Density	Cells ⁻¹	Total Counted	Uncertainty
1,043.0		1,043	6.2%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrium hyalinum		2	0.19
Cerataulina pelagica		2	0.19
Chaetoceros spp.		45	4.31
Climacodium frauenfeldianum		6	0.58
Coscinodiscus nitidis		1	0.10
Coscinodiscus sp. 002		1	0.10
Cylindrotheca closterium		5	0.48
Eucampia sp. 001		2	0.19
Fragilariopsis kergulensis		2	0.19
Navicula spp.		1	0.10
Nitzschia longissima		5	0.48
Proboscia alata		1	0.10
Pseudonitzschia delicatissima group		2	0.19
Rhizosolenia spp.		4	0.38
Thalassiosira sp. 004		7	0.67
Thalassiothrix sp. 001		22	2.11
		108	0.0000
			10.35
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		920	88.21
		920	0.0000
			88.21

Species Name	Density	BioVolume	%
<i>Dictyochophyceae</i>			
Dictyocha fibula var. rhombica	3		0.29
Dictyocha octonaria	1		0.10
	4	0.0000	0.38
<i>Dinophyceae</i>			
Ceratium buceros	2		0.19
Ceratium furca	4		0.38
Ceratium lineatum	2		0.19
Protoperdinium roseum	1		0.10
Pyrocystis lunula	1		0.10
Scrippsiella trochoidea	1		0.10
	11	0.0000	1.05

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 12/08/2014	DSID 24341
Batch Number 140702111841	Sample ID SP7	Date Collected 29/06/2014	
Monitoring Point SP6 - Barossa WV04831	Sample Type Phytoplankton	Date Received 2/07/2014	
Functional Location ID SP6	Method (Detection Limit) Raw Count (1)	Analysis Date 12/08/2014	
Units Reported	Cell Density: Cells ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted

Sampler Notes

Laboratory Notes

Concentrated (phytoplankton net) sample.
Qualitative analysis.
Sedgewick Rafter Chamber (1 ml) - 1 Long transect analysed.

Field Data Recording

Total Density	Cells ⁻¹	Total Counted	Uncertainty
725.0		725	7.4%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Asterolampra sp. 002		1	0.14
Bacteriastrium hyalinum		6	0.83
Bacteriastrium sp. 018		4	0.55
Cerataulina pelagica		8	1.10
Chaetoceros spp.		104	14.34
Climacodium frauenfeldianum		8	1.10
Coscinodiscus nitidis		10	1.38
Coscinodiscus sp. 002		4	0.55
Cylindrotheca closterium		2	0.28
Dactyliosolen antarcticus		11	1.52
Fragilariopsis kergulensis		4	0.55
Hemiaulus sp. 001		1	0.14
Lithodesmium sp. 001		2	0.28
Nitzschia longissima		4	0.55
Pseudonitzschia delicatissima group		5	0.69
Rhizosolenia spp.		10	1.38
Thalassiosira sp. 004		7	0.97
Thalassiothrix sp. 001		7	0.97
		198	0.0000
<i>Cyanobacteria</i>			

Species Name	Density	BioVolume	%
<i>Trichodesmium erythraeum</i>	510		70.34
	510	0.0000	70.34
<i>Dictyochophyceae</i>			
<i>Dictyocha fibula</i> var. <i>rhombica</i>	2		0.28
<i>Dictyocha octonaria</i>	2		0.28
	4	0.0000	0.55
<i>Dinophyceae</i>			
<i>Ceratium breve</i>	1		0.14
<i>Ceratium buceros</i>	1		0.14
<i>Ceratium furca</i>	2		0.28
<i>Ceratium lineatum</i>	3		0.41
<i>Ceratium</i> sp. 054	1		0.14
<i>Dinophysis miles</i>	1		0.14
<i>Ornithocercus splendidus</i>	1		0.14
<i>Phalacroma rotundatum</i>	1		0.14
<i>Protoperidinium roseum</i>	1		0.14
<i>Protoperidinium</i> sp. 032	1		0.14
	13	0.0000	1.79

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 12/08/2014	DSID 24342
Batch Number 140702111947	Sample ID SP10	Date Collected 29/06/2014	
Monitoring Point Barossa	Sample Type Phytoplankton	Date Received 2/07/2014	
Functional Location ID SP10	Method (Detection Limit) Raw Count (1)	Analysis Date 12/08/2014	
Units Reported	Cell Density: Cells ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted

Sampler Notes

Laboratory Notes

Concentrated (phytoplankton net) sample.
Qualitative analysis.
Sedgewick Rafter Chamber (1 ml) - 1 Long transect analysed.

Field Data Recording

Total Density	Cells ⁻¹	Total Counted	Uncertainty
1,800.0		1,800	4.7%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrium hyalinum		5	0.28
Bacteriastrium sp. 018		14	0.78
Cerataulina sp. 004		3	0.17
Chaetoceros spp.		194	10.78
Climacodium frauenfeldianum		72	4.00
Coscinodiscus centralis		1	0.06
Coscinodiscus nitidis		4	0.22
Cylindrotheca closterium		3	0.17
Detonula sp. 001		2	0.11
Diatom 085		3	0.17
Diatom 189		1	0.06
Nitzschia longissima		3	0.17
Proboscia alata		3	0.17
Pseudonitzschia delicatissima group		6	0.33
Pseudonitzschia seriata group		5	0.28
Rhizosolenia setigera		3	0.17
Rhizosolenia spp.		7	0.39
Skeletonema spp.		6	0.33
Thalassiosira sp. 004		16	0.89
Thalassiothrix sp. 001		11	0.61
		362	0.000
			20.11

Species Name	Density	BioVolume	%
Cyanobacteria			
Trichodesmium erythraeum	1,415		78.61
	1,415	0.0000	78.61
Dictyochophyceae			
Dictyocha fibula var. rhombica	5		0.28
Dictyocha octonaria	1		0.06
	6	0.0000	0.33
Dinophyceae			
Ceratium breve	1		0.06
Ceratium furca	2		0.11
Ceratium lineatum	1		0.06
Ceratium sp. 027	3		0.17
Ceratium sp. 054	1		0.06
Ornithocercus splendidus	1		0.06
Oxytoxum scolopax	1		0.06
Prorocentrum mexicanum	1		0.06
Prorocentrum sp. 012	1		0.06
Protoperidinium sp. 018	1		0.06
Protoperidinium sp. 024	1		0.06
Protoperidinium steinii	2		0.11
Scrippsiella trochoidea	1		0.06
	17	0.0000	0.94

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 12/08/2014	DSID 24343
Batch Number 140702112054	Sample ID SP14	Date Collected 26/06/2014	
Monitoring Point WV04831	Sample Type Phytoplankton	Date Received 2/07/2014	
Functional Location ID SP14	Method (Detection Limit) Raw Count (1)	Analysis Date 12/08/2014	
Units Reported	Cell Density: Cells ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted

Sampler Notes

Laboratory Notes

Concentrated (phytoplankton net) sample.
Qualitative analysis.
Sedgewick Rafter Chamber (1 ml) - 1 Long transect analysed.

Field Data Recording

Total Density	Cells ⁻¹	Total Counted	Uncertainty
2,327.0		2,327	4.1%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrium hyalinum		336	14.44
Bacteriastrium sp. 018		54	2.32
Cerataulina pelagica		11	0.47
Cerataulina sp. 004		7	0.30
Chaetoceros spp.		1,038	44.61
Climacodium frauenfeldianum		28	1.20
Corethron criophilum		1	0.04
Corethron sp. 004		1	0.04
Coscinodiscus centralis		5	0.21
Coscinodiscus nitidis		47	2.02
Coscinodiscus sp. 002		2	0.09
Cylindrotheca closterium		11	0.47
Dactyliosolen antarcticus		2	0.09
Dactyliosolen phuketensis		2	0.09
Detonula sp. 001		3	0.13
Diatom 125		69	2.97
Diatom 301		1	0.04
Eucampia cornuta		12	0.52
Eucampia sp. 001		1	0.04
Fragilariopsis kergulensis		31	1.33
Guinardia striata		9	0.39

Species Name	Density	BioVolume	%
Hemiaulus sp. 001	41		1.76
Hemiaulus sp. 006	1		0.04
Leptocylindrus danicus	7		0.30
Meuniera membranacea	6		0.26
Navicula spp.	1		0.04
Nitzschia longissima	8		0.34
Pleurosigma salinarum	1		0.04
Proboscia alata	21		0.90
Pseudo-nitzschia "seriata group"	5		0.21
Pseudonitzschia delicatissima group	3		0.13
Rhizosolenia spp.	63		2.71
Thalassionema frauenfeldii	291		12.51
Thalassiosira sp. 004	8		0.34
Thalassiothrix sp. 001	21		0.90
	2,148	0.0000	92.31
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	142		6.10
	142	0.0000	6.10
<i>Dictyochophyceae</i>			
Dictyocha fibula var. rhombica	13		0.56
Dictyocha octonaria	4		0.17
	17	0.0000	0.73
<i>Dinophyceae</i>			
Amphisolenia sp. 002	1		0.04
Ceratium buceros	1		0.04
Ceratium candelabrum	1		0.04
Ceratium declinatum	1		0.04
Ceratium furca	1		0.04
Ceratium lineatum	2		0.09
Ceratium sp. 032	1		0.04
Ceratium sp. 054	1		0.04
Ornithocercus splendidus	2		0.09
Oxytoxum scolopax	1		0.04
Phalacroma rotundatum	1		0.04
Prorocentrum micans	1		0.04
Prorocentrum sp. 009	2		0.09
Protoperidinium steinii	3		0.13
Scrippsiella trochoidea	1		0.04
	20	0.0000	0.86

Species Name

Density

BioVolume

%

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 8/08/2014	DSID 24344
Batch Number 140702112203	Sample ID SP3	Date Collected 29/06/2014	
Monitoring Point SP3	Sample Type Zooplankton	Date Received 2/07/2014	
Functional Location ID SP3	Method (Detection Limit) Raw Count (1)	Analysis Date 30/07/2014	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Original sample volume = 84 ml.
Sample diluted 25x prior to analysis.
3 x 1ml sub-samples (Sedgewick-Rafter Chamber) analysed.

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
157.0		157	16.0%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		2	1.27
		2	0.0000
<i>Copepoda</i>			
Acartiidae		6	3.82
Calanidae		36	22.93
Copepod Nauplius		14	8.92
Corycaeidae		15	9.55
Macrosetella sp. 001		4	2.55
Oithonidae		12	7.64
Oncaeidae		5	3.18
Paracalanidae		8	5.10
Sulcanidae		4	2.55
Temoridae		1	0.64
		105	0.0000
<i>Foraminifera</i>			
Foraminiferida		2	1.27
		2	0.0000
<i>Malacostraca</i>			

Species Name	Density	BioVolume	%
Anomuran zoea larva	3		1.91
	3	0.0000	1.91
<i>Maxillopoda</i>			
Cirripede nauplius	1		0.64
	1	0.0000	0.64
<i>Ostracoda</i>			
Cypridinidae	1		0.64
	1	0.0000	0.64
<i>Sagittoidea</i>			
Chaetognath	4		2.55
	4	0.0000	2.55
<i>Thaliacea</i>			
Salpidae	1		0.64
	1	0.0000	0.64
<i>Trizonidae</i>			
Trizonidae	37		23.57
	37	0.0000	23.57
<i>Unknown</i>			
Protozoa 047	1		0.64
	1	0.0000	0.64

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 8/08/2014	DSID 24345
Batch Number 140702112325	Sample ID SP5	Date Collected 28/06/2014	
Monitoring Point SP5	Sample Type Zooplankton	Date Received 2/07/2014	
Functional Location ID SP5	Method (Detection Limit) Raw Count (1)	Analysis Date 6/08/2014	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Original sample volume = 66 ml.
Sample diluted 10x prior to analysis.
3 x 1ml sub-samples (Sedgewick-Rafter Chamber) analysed.

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
527.0		527	8.7%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		46	8.73
		46	8.73
<i>Copepoda</i>			
Acartiidae		145	27.51
Calanidae		113	21.44
Copepod Nauplius		97	18.41
Corycaeidae		19	3.61
Macrosetella sp. 001		5	0.95
Microsetella		9	1.71
Oithonidae		21	3.98
Oncaeidae		1	0.19
Paracalanidae		1	0.19
Pontellidae nauplius		2	0.38
Sulcanidae		10	1.90
		423	80.27
<i>Foraminifera</i>			
Foraminiferida		2	0.38
		2	0.38

Species Name	Density	BioVolume	%
<i>Ophiuroidea</i>			
Echinoderm Ophiopluteus Larva	1		0.19
	1	0.0000	0.19
<i>Sagittoidea</i>			
Chaetognath	4		0.76
	4	0.0000	0.76
<i>Trizonidae</i>			
Trizonidae	51		9.68
	51	0.0000	9.68

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project WV04831.104 Timor Sea	Customer Sinclair Knight Merz Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 8/08/2014	DSID 24346
Batch Number 140702112444	Sample ID SP14	Date Collected 26/06/2014	
Monitoring Point WV04831	Sample Type Zooplankton	Date Received 2/07/2014	
Functional Location ID SP14	Method (Detection Limit) Raw Count (1)	Analysis Date 30/07/2014	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Original sample volume = 66 ml.
Sample diluted 100x prior to analysis.
3 x 1ml sub-samples (Sedgewick-Rafter Chamber) analysed.

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
212.0		212	13.7%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		1	0.47
		1	0.0000
			0.47
<i>Copepoda</i>			
Acartiidae		31	14.62
Calanidae		53	25.00
Copepod Nauplius		44	20.75
Corycaeidae		2	0.94
Macrosetella sp. 001		7	3.30
Microsetella		8	3.77
Oncaeidae		1	0.47
Paracalanidae		5	2.36
Sulcanidae		4	1.89
		155	0.0000
			73.11
<i>Foraminifera</i>			
Foraminiferida		4	1.89
		4	0.0000
			1.89
<i>Gigartacotidae</i>			
Gigartacotidae		2	0.94

Species Name	Density	BioVolume	%
	2	0.0000	0.94
<i>Malacostraca</i>			
Hyperidae	1		0.47
	1	0.0000	0.47
<i>Ophiuroidea</i>			
Echinoderm Ophiopluteus Larva	1		0.47
	1	0.0000	0.47
<i>Polycystinea</i>			
Theoperidae	2		0.94
	2	0.0000	0.94
<i>Sagittoidea</i>			
Chaetognath	2		0.94
	2	0.0000	0.94
<i>Trizonidae</i>			
Trizonidae	44		20.75
	44	0.0000	20.75

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Appendix C1. Summer



Environmental

CERTIFICATE OF ANALYSIS

Work Order : **EP1500461** Page : 1 of 13

Client : **JACOBS GROUP (AUSTRALIA) PTY LTD** Laboratory : Environmental Division Perth

Contact : **MR CHRIS TEASDALE** Contact : **Scott James**

Address : **P O BOX H615** Address : **10 Hod Way Malaga WA Australia 6090**

E-mail : **perth.enviro.services@alsglobal.com** E-mail : **perth.enviro.services@alsglobal.com**

Telephone : **+61 08 9469 4400** Telephone : **+61-8-9209 7655**

Facsimile : **+61 08 9469 4488** Facsimile : **+61-8-9209 7600**

Project : **IW021200** QC Level : **NEPM 2013 Schedule B(3) and ALS QCS3 requirement**

Order number : **IW021200.104** Date Samples Received : **23-JAN-2015**

C-O-C number : **----** Issue Date : **29-JAN-2015**

Sampler : **K.R.** No. of samples received : **48**

Site : **----** No. of samples analysed : **48**

Quote number : **EP/370/14**

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

WORLD RECOGNISED
ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Agnes Szilagyi	Senior Organic Chemist	Perth Organics



Page : 2 of 13
Work Order : EP1500461
Client : JACOBS GROUP (AUSTRALIA) PTY LTD
Project : IW021200

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP1-S	SP1-M	SP1-B	SP2-S	SP2-M
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	94.5	105	104	99.8	103	103	103
Toluene-D8	2037-26-5	0.1	101	96.6	98.5	99.2	98.1	98.1	98.1
4-Bromofluorobenzene	460-00-4	0.1	96.7	98.6	97.9	97.3	96.0	96.0	96.0



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP2-B	SP3-S	SP3-M	SP3-B	SP4-S
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20		19-JAN-2015 14:10	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50		19-JAN-2015 14:10	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100		19-JAN-2015 14:10	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50		19-JAN-2015 14:10	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50		19-JAN-2015 14:10	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	20-JAN-2015 07:00	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	20-JAN-2015 07:00	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	19-JAN-2015 14:10	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	19-JAN-2015 14:10	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	19-JAN-2015 14:10	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	19-JAN-2015 14:10	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	19-JAN-2015 14:10	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	19-JAN-2015 14:10	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	19-JAN-2015 14:10	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	19-JAN-2015 14:10	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	µg/L	19-JAN-2015 14:10	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	19-JAN-2015 14:10	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	19-JAN-2015 14:10	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	µg/L	19-JAN-2015 14:10	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	19-JAN-2015 14:10	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%	19-JAN-2015 14:10	99.5	98.1	100	101	99.1
Toluene-D8	2037-26-5	0.1	%	19-JAN-2015 14:10	99.3	101	99.3	98.3	99.9
4-Bromofluorobenzene	460-00-4	0.1	%	19-JAN-2015 14:10	95.4	95.1	94.8	95.1	94.8



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP4-M	SP4-B	SP5-S	SP5-M	SP5-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	96.4	102	101	99.1	101	99.1	101
Toluene-D8	2037-26-5	0.1	101	99.1	99.7	100	100	99.2	99.2
4-Bromofluorobenzene	460-00-4	0.1	93.6	93.5	93.8	93.5	93.5	93.8	93.8



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP6-S	SP6-M	SP6-B	SP7-S	SP7-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	97.9	94.8	94.2	95.6	100	100	100
Toluene-D8	2037-26-5	0.1	101	102	102	101	99.4	99.4	99.4
4-Bromofluorobenzene	460-00-4	0.1	92.3	91.4	90.7	91.6	92.8	92.8	92.8



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP8-S	SP8-M	SP8-B	SP9-S	SP9-M
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	97.3	95.5	97.8	95.2	95.2	103	103
Toluene-D8	2037-26-5	0.1	101	101	101	101	101	98.2	98.2
4-Bromofluorobenzene	460-00-4	0.1	89.1	89.7	89.8	88.9	88.9	92.2	92.2



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP9-B	SP10-S	SP10-M	SP10-B	SP11-S
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20		18-JAN-2015 13:30	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50		18-JAN-2015 09:16	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100		18-JAN-2015 09:16	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50		18-JAN-2015 09:16	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50		18-JAN-2015 09:16	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20		18-JAN-2015 09:16	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20		18-JAN-2015 09:16	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100		18-JAN-2015 09:16	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100		18-JAN-2015 09:16	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100		18-JAN-2015 09:16	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100		18-JAN-2015 09:16	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100		18-JAN-2015 09:16	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	18-JAN-2015 09:16	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	18-JAN-2015 09:16	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	18-JAN-2015 09:16	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	µg/L	18-JAN-2015 09:16	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	18-JAN-2015 09:16	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	18-JAN-2015 09:16	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	18-JAN-2015 09:16	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	18-JAN-2015 09:16	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%	18-JAN-2015 09:16	97.3	98.0	96.3	97.8	94.8
Toluene-D8	2037-26-5	0.1	%	18-JAN-2015 09:16	101	101	100	102	102
4-Bromofluorobenzene	460-00-4	0.1	%	18-JAN-2015 09:16	90.6	89.6	89.5	89.0	89.4



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID	
Compound	CAS Number	Client sampling date / time	Unit
	LOR	SP11-B	SP12-S
		18-JAN-2015 16:55 EP1500461-031	18-JAN-2015 15:50 EP1500461-032
		SP12-M	SP12-B
		18-JAN-2015 15:50 EP1500461-033	18-JAN-2015 15:50 EP1500461-034
		SP13-S	
		19-JAN-2015 07:20 EP1500461-035	
EP080/071: Total Petroleum Hydrocarbons			
C6 - C9 Fraction	20	<20	<20
C10 - C14 Fraction	50	<50	<50
C15 - C28 Fraction	100	<100	<100
C29 - C36 Fraction	50	<50	<50
^ C10 - C36 Fraction (sum)	50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions			
C6 - C10 Fraction	C6_C10	20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20
>C10 - C16 Fraction	>C10_C16	100	<100
>C16 - C34 Fraction	100	<100	<100
>C34 - C40 Fraction	100	<100	<100
^ >C10 - C40 Fraction (sum)	100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	100	<100	<100
EP080: BTEXN			
Benzene	71-43-2	1	<1
Toluene	108-88-3	2	<2
Ethylbenzene	100-41-4	2	<2
meta- & para-Xylene	108-38-3	2	<2
ortho-Xylene	95-47-6	2	<2
^ Total Xylenes	1330-20-7	2	<2
^ Sum of BTEX	-----	1	<1
Naphthalene	91-20-3	5	<5
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	0.1	97.1
Toluene-D8	2037-26-5	0.1	101
4-Bromofluorobenzene	460-00-4	0.1	89.0
			99.4
			100
			88.4
			96.0
			101
			99.4
			90.4
			100
			99.4
			91.0



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID	
Compound	CAS Number	Client sampling date / time	Unit
	LOR	SP13-M	SP13-B
		19-JAN-2015 07:20	19-JAN-2015 07:20
		EP1500461-036	EP1500461-037
		SP14-M	SP14-S
		19-JAN-2015 08:40	19-JAN-2015 08:40
		EP1500461-039	EP1500461-038
		SP14-B	SP14-M
		19-JAN-2015 08:40	19-JAN-2015 08:40
		EP1500461-040	EP1500461-040
EP080/071: Total Petroleum Hydrocarbons			
C6 - C9 Fraction	20	<20	<20
C10 - C14 Fraction	50	<50	<50
C15 - C28 Fraction	100	<100	<100
C29 - C36 Fraction	50	<50	<50
^ C10 - C36 Fraction (sum)	50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions			
C6 - C10 Fraction	C6_C10	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	<20	<20
>C10 - C16 Fraction	>C10_C16	<100	<100
>C16 - C34 Fraction	100	<100	<100
>C34 - C40 Fraction	100	<100	<100
^ >C10 - C40 Fraction (sum)	100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	100	<100	<100
EP080: BTEXN			
Benzene	71-43-2	<1	<1
Toluene	108-88-3	<2	<2
Ethylbenzene	100-41-4	<2	<2
meta- & para-Xylene	108-38-3	<2	<2
ortho-Xylene	95-47-6	<2	<2
^ Total Xylenes	1330-20-7	<2	<2
^ Sum of BTEX	-----	<1	<1
Naphthalene	91-20-3	<5	<5
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	101	94.8
Toluene-D8	2037-26-5	99.2	100
4-Bromofluorobenzene	460-00-4	89.0	88.5
			101
			99.2
			89.0
			100
			99.5
			89.5
			101
			98.7
			88.6
			100
			99.5
			89.5
			95.7
			103
			99.5



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP15-S	SP15-M	SP15-B	SP16-S	SP16-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	94.7	104	105	106	102	102	102
Toluene-D8	2037-26-5	0.1	102	98.6	101	100	101	101	101
4-Bromofluorobenzene	460-00-4	0.1	93.4	88.4	90.1	92.6	88.6	88.6	88.6



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

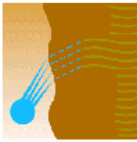
Compound	CAS Number	LOR	Client sample ID	
			Client sampling date / time	Unit
EP080/071: Total Petroleum Hydrocarbons				
C6 - C9 Fraction		20	<20	<20
C10 - C14 Fraction		50	<50	<50
C15 - C28 Fraction		100	<100	<100
C29 - C36 Fraction		50	<50	<50
^ C10 - C36 Fraction (sum)		50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions				
C6 - C10 Fraction	C6_C10	20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100
>C16 - C34 Fraction		100	<100	<100
>C34 - C40 Fraction		100	<100	<100
^ >C10 - C40 Fraction (sum)		100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)		100	<100	<100
EP080: BTEXN				
Benzene	71-43-2	1	<1	<1
Toluene	108-88-3	2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2
^ Sum of BTEX		1	<1	<1
Naphthalene	91-20-3	5	<5	<5
EP080S: TPH(V)/BTEX Surrogates				
1,2-Dichloroethane-D4	17060-07-0	0.1	104	109
Toluene-D8	2037-26-5	0.1	100	97.6
4-Bromofluorobenzene	460-00-4	0.1	88.4	86.8



Page : 13 of 13
Work Order : EP1500461
Client : JACOBS GROUP (AUSTRALIA) PTY LTD
Project : IW021200

Surrogate Control Limits

Sub-Matrix: WATER			
Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP080S: TPH(V)/BTX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	60.5	141.2
Toluene-D8	2037-26-5	73.4	126
4-Bromofluorobenzene	460-00-4	59.6	125.3



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Contact: Celeste Wilson
Customer: Jacobs

Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 17/02/2015
Date Received: 22/01/2015
Our Reference: JAC14-12
Your Reference: IW021200.104

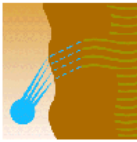
WATER QUALITY DATA

METHOD	Sampling Date	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	3000 CHLOROPHYLL'a µg/L	3000 PHAEOPHYTIN'a µg/L	2540D TSS mg/L
Reporting Limit		<3	<2	<2	<5	<50	<0.1	<0.2	<0.5
File		15012902_020901	15020301_1201	15012803	150127				
SP1-S	20/01/2015	<3	4	<2	13	90	0.1	<0.2	
SP1-M	20/01/2015	<3	35	230	42	300	<0.1	<0.2	
SP1-B	20/01/2015	<3	56	380	62	420	<0.1	<0.2	
SP2-S	20/01/2015	<3	4	2	13	110	<0.1	<0.2	<0.5
SP2-M	20/01/2015	3	32	210	36	270	<0.1	<0.2	
SP2-B	20/01/2015	6	54	370	59	420	<0.1	<0.2	
SP3-S	19/01/2015	<3	3	<2	14	90	<0.1	<0.2	0.8
SP3-M	19/01/2015	<3	31	230	36	270	<0.1	<0.2	
SP3-B	19/01/2015	<3	39	290	58	400	<0.1	<0.2	
SP4-S	19/01/2015	<3	4	<2	14	80	0.1	<0.2	
SP4-M	19/01/2015	<3	27	200	33	240	<0.1	<0.2	
SP4-B	19/01/2015	3	47	340	51	360	<0.1	<0.2	
SP5-S	19/01/2015	<3	4	<2	13	100	0.1	<0.2	
SP5-M	19/01/2015	<3	34	230	40	260	<0.1	<0.2	
SP5-B	19/01/2015	5	46	330	52	360	<0.1	<0.2	<0.5
SP6-S	19/01/2015	3	3	<2	14	100	0.1	<0.2	
SP6-M	19/01/2015	8	23	150	35	260	<0.1	<0.2	
SP6-B	19/01/2015	4	43	280	57	400	<0.1	<0.2	
SP7-S	18/01/2015	4	4	2	12	100	0.1	<0.2	0.7
SP7-B	18/01/2015	<3	4	2	13	90	0.2	<0.2	

Signatory: Jamie Woodward
Date: 17/02/2015

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Environmental Science**

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**Murdoch
UNIVERSITY**

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Customer: Jacobs

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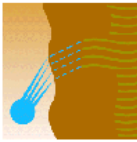
WATER QUALITY DATA

METHOD	Sampling Date	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	3000 CHLOROPHYLL'a µg/L	3000 PHAEOPHYTIN'a µg/L	2540D TSS mg/L
Reporting Limit		<3	<2	<2	<5	<50	<0.1	<0.2	<0.5
File		15012902,020901	15020301,1201	15012803	150127				
SP8-S	18/01/2015	<3	4	<2	12	90	0.2	<0.2	
SP8-M	18/01/2015	5	5	<2	14	80	0.3	<0.2	
SP8-B	18/01/2015	3	25	170	32	240	0.2	<0.2	
SP9-S	18/01/2015	5	5	2	14	90	0.1	<0.2	
SP9-M	18/01/2015	5	28	190	35	310	0.2	<0.2	
SP9-B	18/01/2015	7	32	180	43	320	<0.1	<0.2	
SP10-S	18/01/2015	<3	5	<2	14	80	0.1	<0.2	
SP10-M	18/01/2015	<3	24	150	30	220	0.2	<0.2	
SP10-B	18/01/2015	8	43	300	48	350	<0.1	<0.2	
SP11-S	18/01/2015	4	3	<2	13	90	0.2	<0.2	
SP11-B	18/01/2015	<3	3	<2	13	110	0.3	<0.2	
SP12-S	18/01/2015	4	4	<2	14	120	0.2	<0.2	0.8
SP12-M	18/01/2015	37	7	3	15	90	0.8	0.2	
SP12-B	18/01/2015	4	33	210	39	280	0.2	<0.2	
SP13-S	19/01/2015	9	5	<2	14	110	0.2	<0.2	
SP13-M	19/01/2015	<3	7	<2	18	100	0.9	0.4	
SP13-B	19/01/2015	<3	30	200	38	260	0.3	0.5	
SP14-S	19/01/2015	5	4	<2	14	90	0.2	<0.2	
SP14-M	19/01/2015	<3	4	<2	16	100	0.9	0.4	
SP14-B	19/01/2015	<3	30	190	37	250	0.3	0.5	

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WATER QUALITY DATA

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METHOD	2000	4100	2100	4700	2700	3000	3000	2540D
SAMPLE CODE	AMMONIA	ORTHO-P	NO3+NO2	TOTAL-P	TOTAL-N	CHLOROPHYLL'a'	PHAEOPHYTIN'a'	TSS
Reporting Limit	µg.N/L	µg.P/L	µg.N/L	µg.P/L	µg.N/L	µg/L	µg/L	mg/L
File	15012902,020901	15020301,1201	15012803	150127				
SP15-S	<3	4	2	13	100	<0.1	<0.2	
SP15-M	<3	6	5	15	90	0.4	<0.2	
SP15-B	<3	30	190	37	260	0.1	<0.2	
SP16-S	<3	4	<2	14	80	<0.1	<0.2	1.0
SP16-B	<3	4	<2	13	90	0.2	<0.2	
SP17-S	<3	4	<2	12	100	<0.1	<0.2	
SP17-M	<3	7	16	16	100	0.5	0.2	
SP17-B	<3	30	180	37	250	0.1	<0.2	
Field Blank	<3	<2	<2	<5	<50	<0.1	<0.2	
Trans Blank	<3	<2	<2	<5	<50	<0.1	<0.2	

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Date: 17/02/2015

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WATER QUALITY DATA

Date of Issue: 17/02/2015
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Your Reference: IW021200.104

METHOD	Sampling Date	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	ICP006 Hg mg/L
SP1-S	20/01/2015	<0.2	<0.05	<0.3	0.2	2	1.6	<0.1	5.0	<0.1	<0.0001
SP1-M	20/01/2015	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.5	<0.1	<0.0001
SP1-B	20/01/2015	<0.2	<0.05	0.3	0.2	1	1.7	<0.1	7.1	<0.1	<0.0001
SP2-S	20/01/2015	<0.2	<0.05	<0.3	0.4	2	1.6	<0.1	5.1	<0.1	<0.0001
SP2-M	20/01/2015	<0.2	<0.05	<0.3	0.2	<1	1.6	<0.1	5.5	<0.1	<0.0001
SP2-B	20/01/2015	<0.2	<0.05	0.3	0.3	4	1.8	<0.1	6.8	<0.1	<0.0001
SP3-S	19/01/2015	<0.2	<0.05	<0.3	0.3	1	1.6	<0.1	5.3	<0.1	<0.0001
SP3-M	19/01/2015	<0.2	<0.05	<0.3	<0.2	2	1.7	<0.1	5.3	<0.1	<0.0001
SP3-B	19/01/2015	<0.2	<0.05	0.3	<0.2	1	1.8	<0.1	6.2	<0.1	<0.0001
SP4-S	19/01/2015	<0.2	<0.05	<0.3	0.2	<1	1.6	<0.1	5.1	<0.1	<0.0001
SP4-M	19/01/2015	<0.2	<0.05	<0.3	0.3	1	1.7	<0.1	5.3	<0.1	<0.0001
SP4-B	19/01/2015	<0.2	<0.05	0.3	0.2	1	1.8	<0.1	6.3	<0.1	<0.0001
SP5-S	19/01/2015	<0.2	<0.05	<0.3	0.3	<1	1.6	<0.1	5.3	<0.1	<0.0001
SP5-M	19/01/2015	<0.2	<0.05	<0.3	0.2	1	1.7	<0.1	5.6	<0.1	<0.0001
SP5-B	19/01/2015	<0.2	<0.05	<0.3	0.2	2	1.7	<0.1	6.4	<0.1	<0.0001
SP6-S	19/01/2015	<0.2	<0.05	<0.3	0.3	2	1.6	<0.1	5.2	<0.1	<0.0001
SP6-M	19/01/2015	<0.2	<0.05	<0.3	0.3	3	1.7	<0.1	5.4	<0.1	<0.0001
SP6-B	19/01/2015	<0.2	<0.05	0.3	0.3	3	1.8	<0.1	6.8	<0.1	<0.0001
SP7-S	18/01/2015	<0.2	<0.05	<0.3	0.4	1	1.6	<0.1	5.4	0.1	<0.0001
SP7-B	18/01/2015	<0.2	<0.05	<0.3	0.3	2	1.6	<0.1	5.4	<0.1	<0.0001

File

15012901-02

Signatory: Jamie Woodward
Date: 17/02/2015

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Contact: Celeste Wilson
Customer: Jacobs

Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 17/02/2015
Date Received: 22/01/2015
Our Reference: JAC14-12
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD	Sampling Date	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	ICP006 Hg mg/L
SP8-S	18/01/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001
SP8-M	18/01/2015	<0.2	<0.05	<0.3	0.2	<1	1.6	<0.1	5.4	<0.1	<0.0001
SP8-B	18/01/2015	<0.2	<0.05	<0.3	0.3	2	1.6	<0.1	5.5	<0.1	<0.0001
SP9-S	18/01/2015	<0.2	<0.05	<0.3	0.4	2	1.8	<0.1	5.6	<0.1	<0.0001
SP9-M	18/01/2015	<0.2	<0.05	0.3	0.3	1	1.8	<0.1	5.5	0.2	<0.0001
SP9-B	18/01/2015	<0.2	<0.05	0.4	0.4	2	1.8	<0.1	5.6	<0.1	<0.0001
SP10-S	18/01/2015	<0.2	<0.05	0.4	0.3	3	1.9	<0.1	6.0	<0.1	<0.0001
SP10-M	18/01/2015	<0.2	<0.05	<0.3	0.2	1	1.7	<0.1	5.5	<0.1	<0.0001
SP10-B	18/01/2015	<0.2	<0.05	<0.3	0.3	3	1.8	<0.1	5.9	<0.1	<0.0001
SP11-S	18/01/2015	<0.2	<0.05	0.4	0.4	4	1.9	<0.1	6.3	<0.1	<0.0001
SP11-B	18/01/2015	<0.2	<0.05	<0.3	0.4	2	1.5	<0.1	5.0	<0.1	<0.0001
SP12-S	18/01/2015	<0.2	<0.05	0.3	0.3	<1	1.7	<0.1	5.2	<0.1	<0.0001
SP12-M	18/01/2015	<0.2	<0.05	<0.3	0.3	1	1.7	<0.1	5.2	<0.1	<0.0001
SP12-B	18/01/2015	<0.2	<0.05	<0.3	0.5	5	1.8	<0.1	5.5	<0.1	<0.0001
SP13-S	19/01/2015	<0.2	<0.05	0.3	0.3	3	1.9	<0.1	5.8	<0.1	<0.0001
SP13-M	19/01/2015	<0.2	<0.05	0.3	0.4	4	1.7	<0.1	5.7	<0.1	<0.0001
SP13-B	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.7	<0.1	<0.0001
SP14-S	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.7	<0.1	<0.0001
SP14-M	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.4	<0.1	<0.0001
SP14-B	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.5	<0.1	<0.0001
					<0.2	1	1.8	<0.1	5.8	<0.1	<0.0001

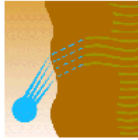
File

15012901-02

Signatory: Jamie Woodward
Date: 17/02/2015

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Contact: Celeste Wilson
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WATER QUALITY DATA

Date of Issue: 17/02/2015
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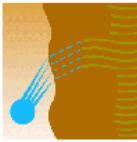
METHOD	Sampling Date	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	ICP006 Hg mg/L
SP15-S	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.5	<0.1	5.6	<0.1	<0.0001
SP15-M	20/01/2015	<0.2	<0.05	<0.3	<0.2	1	1.8	<0.1	5.6	<0.1	<0.0001
SP15-B	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.8	<0.1	<0.0001
SP16-S	20/01/2015	<0.2	<0.05	<0.3	<0.2	1	1.6	<0.1	5.6	<0.1	<0.0001
SP16-B	20/01/2015	<0.2	<0.05	<0.3	<0.2	1	1.6	<0.1	5.4	<0.1	<0.0001
SP17-S	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.7	<0.1	<0.0001
SP17-M	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.7	<0.1	<0.0001
SP17-B	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.9	<0.1	<0.0001
Field Blank	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001
Trans Blank	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001

15012901-02

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Date: 17/02/2015

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Date of Issue: 17/02/2015
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Our Reference: JAC14-12
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WATER QUALITY DATA

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	MS001 Unfiltered Total Ext Hg mg/L
SP1-S	20/01/2015	<0.2	<0.05	<0.3	0.3	2	1.6	<0.1	5.1	<0.1	<0.0001
SP1-M	20/01/2015	<0.2	<0.05	<0.3	0.2	<1	1.7	<0.1	5.5	<0.1	<0.0001
SP1-B	20/01/2015	<0.2	<0.05	0.3	0.2	1	1.9	<0.1	7.0	<0.1	<0.0001
SP2-S	20/01/2015	<0.2	<0.05	<0.3	0.5	3	1.6	<0.1	5.2	<0.1	<0.0001
SP2-M	20/01/2015	<0.2	<0.05	<0.3	0.3	<1	1.8	<0.1	5.6	<0.1	<0.0001
SP2-B	20/01/2015	<0.2	<0.05	0.4	0.3	3	1.7	<0.1	6.9	<0.1	<0.0001
SP3-S	19/01/2015	<0.2	<0.05	<0.3	0.2	1	1.6	<0.1	5.4	<0.1	<0.0001
SP3-M	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001
SP3-B	19/01/2015	<0.2	<0.05	0.4	0.3	<1	1.8	<0.1	6.3	<0.1	<0.0001
SP4-S	19/01/2015	<0.2	<0.05	<0.3	0.5	<1	1.6	<0.1	5.2	<0.1	<0.0001
SP4-M	19/01/2015	<0.2	<0.05	<0.3	0.3	1	1.7	<0.1	5.0	<0.1	<0.0001
SP4-B	19/01/2015	<0.2	<0.05	0.5	0.7	4	1.8	<0.1	6.4	<0.1	<0.0001
SP5-S	19/01/2015	<0.2	<0.05	<0.3	0.6	3	1.6	<0.1	5.3	<0.1	<0.0001
SP5-M	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001
SP5-B	19/01/2015	<0.2	<0.05	0.3	0.2	<1	1.8	<0.1	6.1	<0.1	<0.0001
SP6-S	19/01/2015	<0.2	<0.05	<0.3	0.3	2	1.6	<0.1	5.3	<0.1	<0.0001
SP6-M	19/01/2015	<0.2	<0.05	<0.3	0.3	2	1.8	<0.1	5.5	<0.1	<0.0001
SP6-B	19/01/2015	<0.2	<0.05	0.3	0.2	2	1.8	<0.1	6.8	<0.1	<0.0001
SP7-S	18/01/2015	<0.2	<0.05	<0.3	0.6	1	1.7	<0.1	5.4	0.2	<0.0001
SP7-B	18/01/2015	<0.2	<0.05	<0.3	0.4	2	1.7	<0.1	5.6	<0.1	<0.0001

File 15013001-02

Signatory: Jamie Woodward
Date: 17/02/2015

All test items tested as received. Spare test items will be held for two months unless otherwise requested.

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**Marine and Freshwater
Research Laboratory
Environmental Science**

Tel: +61 8 93602907 Address: 90 South St, Murdoch, WA, 6150



Accreditation Number: 10603
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The results of the tests, calibrations and/or
measurements included in this document are
traceable to Australian/national standards.



Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 17/02/2015
Date Received: 22/01/2015
Our Reference: JAC14-12
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	MS001 Unfiltered Total Ext Hg mg/L
SP8-S	18/01/2015	<0.2	<0.05	<0.3	0.2	1	1.6	<0.1	5.3	<0.1	<0.0001
SP8-M	18/01/2015	<0.2	<0.05	<0.3	0.4	2	1.7	<0.1	5.6	<0.1	<0.0001
SP8-B	18/01/2015	<0.2	<0.05	<0.3	0.3	2	1.8	<0.1	5.9	<0.1	<0.0001
SP9-S	18/01/2015	<0.2	<0.05	<0.3	0.3	1	1.8	<0.1	5.6	0.2	<0.0001
SP9-M	18/01/2015	<0.2	<0.05	0.3	0.4	2	1.8	<0.1	5.8	<0.1	<0.0001
SP9-B	18/01/2015	<0.2	<0.05	0.4	0.3	2	1.9	<0.1	6.0	<0.1	<0.0001
SP10-S	18/01/2015	<0.2	<0.05	<0.3	0.2	1	1.7	<0.1	5.6	<0.1	<0.0001
SP10-M	18/01/2015	<0.2	<0.05	0.3	0.2	3	1.9	<0.1	6.0	<0.1	<0.0001
SP10-B	18/01/2015	<0.2	<0.05	0.4	0.4	4	1.9	<0.1	6.4	<0.1	<0.0001
SP11-S	18/01/2015	<0.2	<0.05	<0.3	0.2	2	1.6	<0.1	5.3	<0.1	<0.0001
SP11-B	18/01/2015	<0.2	<0.05	0.3	0.3	<1	1.8	<0.1	5.6	<0.1	<0.0001
SP12-S	18/01/2015	<0.2	<0.05	<0.3	0.3	2	1.7	<0.1	5.2	<0.1	<0.0001
SP12-M	18/01/2015	<0.2	<0.05	<0.3	0.2	1	1.9	<0.1	5.5	<0.1	<0.0001
SP12-B	18/01/2015	<0.2	<0.05	0.3	0.2	3	1.9	<0.1	5.8	<0.1	<0.0001
SP13-S	19/01/2015	<0.2	<0.05	0.3	0.5	4	1.6	<0.1	5.5	<0.1	<0.0001
SP13-M	19/01/2015	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.8	<0.1	<0.0001
SP13-B	19/01/2015	0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.7	<0.1	<0.0001
SP14-S	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.4	<0.1	<0.0001
SP14-M	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.8	<0.1	<0.0001
SP14-B	19/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.8	<0.1	<0.0001

15013001-02

Jamie Woodward

Signatory: Jamie Woodward
Date: 17/02/2015

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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

WATER QUALITY DATA

Date of Issue: 17/02/2015
Date Received: 22/01/2015
Our Reference: JAC14-12
Your Reference: IW021200.104

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	MS001 Unfiltered Total Ext Hg mg/L	ICP006
SP15-S	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001
SP15-M	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.5	<0.1	5.6	<0.1	<0.0001	<0.0001
SP15-B	20/01/2015	0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.7	<0.1	<0.0001	<0.0001
SP16-S	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.8	<0.1	<0.0001	<0.0001
SP16-B	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	1.5	<0.1	5.5	<0.1	<0.0001	<0.0001
SP17-S	20/01/2015	<0.2	<0.05	<0.3	0.2	<1	1.7	<0.1	5.4	<0.1	<0.0001	<0.0001
SP17-M	20/01/2015	<0.2	<0.05	<0.3	<0.2	2	1.7	<0.1	5.6	<0.1	<0.0001	<0.0001
SP17-B	20/01/2015	<0.2	<0.05	0.4	<0.2	1	1.8	<0.1	5.7	<0.1	<0.0001	<0.0001
Field Blank	20/01/2015	<0.2	<0.05	<0.3	<0.2	1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001
Trans Blank	20/01/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001

File 15013001-02

Signatory: Jamie Woodward
Date: 17/02/2015

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No. 14174

18 March 2015

Ref: 9189
Contract: MW 1725
Page 1 of 3

Sinclair Knight Merz – JACOBS PROJECT
7th Floor Durack Centre
PERTH WA 6000

Attn: Celeste Wilson
Jacobs Project#:WV04831.104

ANALYTICAL REPORT

The results (to 95%, 2 σ confidence level) for Radium-226, Radium-228 and Thorium-228 analyses of forty eight(48) liquid samples, as received at our laboratory on 10 February 2015, are detailed on page two and three of this report.

MDL:	Radium-226	0.100 Bq/l	Radium-228	0.100 Bq/l
	Thorium-228	0.100 Bq/l		

Method: LTP No. 4(a) Gamma Spectrometry Analysis


Madassar A. Qureshi
Authorised Signatory

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WRS No	Client Sample ID	Ra-226 (Bq/l)	Ra-228 (Bq/l)	Th-228 (Bq/l)
9189-1	SP1-S 20/01/2015	<MDL	<MDL	<MDL
9189-2	SP1-M 20/01/2015	<MDL	<MDL	<MDL
9189-3	SP1-B 20/01/2015	<MDL	<MDL	<MDL
9189-4	SP2-S 20/01/2015	<MDL	<MDL	<MDL
9189-5	SP2-M 20/01/2015	<MDL	<MDL	<MDL
9189-6	SP2-B 20/01/2015	0.114 ± 0.025	0.116 ± 0.053	<MDL
9189-7	SP3-S 19/01/2015	<MDL	<MDL	<MDL
9189-8	SP3-M 19/01/2015	<MDL	<MDL	<MDL
9189-9	SP3-B 19/01/2015	<MDL	<MDL	<MDL
9189-10	SP4-S 19/01/2015	0.115 ± 0.014	<MDL	<MDL
9189-10D	SP4-S 19/01/2015	0.118 ± 0.015	<MDL	<MDL
9189-11	SP4-M 19/01/2015	0.107 ± 0.048	<MDL	<MDL
9189-12	SP4-B 19/01/2015	<MDL	0.109 ± 0.039	<MDL
9189-13	SP5-S 19/01/2015	<MDL	<MDL	<MDL
9189-14	SP5-M 19/01/2015	<MDL	<MDL	<MDL
9189-15	SP5-B 19/01/2015	<MDL	<MDL	<MDL
9189-16	SP6-S 19/01/2015	<MDL	<MDL	<MDL
9189-17	SP6-M 19/01/2015	<MDL	<MDL	<MDL
9189-18	SP6-B 19/01/2015	<MDL	<MDL	<MDL
9189-19	SP7-S 18/01/2015	<MDL	<MDL	<MDL
9189-20	SP7-B 18/01/2015	<MDL	<MDL	<MDL
9189-20D	SP7-B 18/01/2015	<MDL	<MDL	<MDL
9189-21	SP8-S 18/01/2015	<MDL	<MDL	<MDL
9189-22	SP8-M 18/01/2015	<MDL	<MDL	<MDL
9189-23	SP8-B 18/01/2015	<MDL	0.112 ± 0.020	<MDL
9189-24	SP9-S 18/01/2015	<MDL	<MDL	<MDL
9189-25	SP9-M 18/01/2015	<MDL	<MDL	<MDL
9189-26	SP9-B 18/01/2015	<MDL	<MDL	<MDL

Ref: 9189
Page 2 of 3



WRS No	Client Sample ID	Ra-226 (Bq/g)	Ra-228 (Bq/g)	Th-228 (Bq/l)
9189-27	SP10-S 18/01/2015	<MDL	<MDL	<MDL
9189-28	SP10-M 18/01/2015	<MDL	<MDL	<MDL
9189-29	SP10-B 18/01/2015	<MDL	<MDL	<MDL
9189-30	SP11-S 18/01/2015	<MDL	<MDL	<MDL
9189-30D	SP11-S 18/01/2015	<MDL	<MDL	<MDL
9189-31	SP11-B 18/01/2015	<MDL	<MDL	<MDL
9189-32	SP12-S 18/01/2015	<MDL	<MDL	<MDL
9189-33	SP12-M 18/01/2015	<MDL	<MDL	<MDL
9189-34	SP12-B 18/01/2015	<MDL	<MDL	<MDL
9189-35	SP13-S 19/01/2015	<MDL	<MDL	<MDL
9189-36	SP13-M 19/01/2015	<MDL	<MDL	<MDL
9189-37	SP13-B 19/01/2015	<MDL	<MDL	<MDL
9189-38	SP14-S 19/01/2015	<MDL	<MDL	<MDL
9189-39	SP14-M 19/01/2015	<MDL	<MDL	<MDL
9189-40	SP14-B 19/01/2015	<MDL	<MDL	<MDL
9189-40D	SP14-B 19/01/2015	<MDL	<MDL	<MDL
9189-41	SP15-S 20/01/2015	<MDL	<MDL	<MDL
9189-42	SP15-M 20/01/2015	0.133 ± 0.047	<MDL	<MDL
9189-43	SP15-B 20/01/2015	<MDL	<MDL	<MDL
9189-44	SP16-S 20/01/2015	<MDL	<MDL	<MDL
9189-45	SP16-B 20/01/2015	<MDL	<MDL	<MDL
9189-46	SP17-S 20/01/2015	<MDL	<MDL	<MDL
9189-47	SP17-M 20/01/2015	<MDL	<MDL	<MDL
9189-48	SP17-B 20/01/2015	<MDL	<MDL	<MDL

The reported expanded uncertainty of measurement is stated as the standard uncertainty of the measurement $\pm 5.6\%$, multiplied by the coverage factor $k=2$, which corresponds to a coverage probability of approximately 95%.

Ref: 9189
Page 3 of 3

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26281
Batch Number 150123145338	Sample ID SP1-S - PHYTO	Date Collected 20/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 18/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
127,551.0		697	7.6%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrium hyalinum	549		0.43
Cerataulina pelagica	366		0.29
Chaetoceros spp.	2,379		1.87
Dactyliosolen phuketensis	183		0.14
Entomoneis tenuistriata	183		0.14
Nitzschia longissima	366		0.29
Planktoniella sol	183		0.14
Pseudo-nitzschia "delicatissima group"	2,013		1.58
Pseudo-nitzschia "seriata group"	549		0.43
Rhizosolenia setigera	183		0.14
Rhizosolenia shrubsolei	183		0.14
Rhizosolenia striata	366		0.29
Skeletonema sp.	549		0.43
Thalassionema frauenfeldii	549		0.43
Thalassiothrix sp. 001	549		0.43
	9,150	0.0000	7.17
<i>Cryptophyceae</i>			
Cryptophyte 014	183		0.14
	183	0.0000	0.14

Species Name	Density	BioVolume	%
Cyanobacteria			
Trichodesmium erythraeum	116,937		91.68
	116,937	0.0000	91.68
Dinophyceae			
Ceratium buceros	183		0.14
Ceratium sp. 033	366		0.29
Dinophysis caudata var. pediculata	366		0.29
Protoperidinium sp. 018	366		0.29
	1,281	0.0000	1.00

End Of Report

This report contains coloured shading. Dalcon Environmental intends that this report be viewed and/or printed in colour.

Dalcon Environmental Pty Ltd makes no claim that the taxa list provided herein is exhaustive. Some taxa, including potentially problematic taxa, may be present in the sample but not recorded during analysis, this is particularly the case for small or inconspicuous taxa or taxa present in low numbers. Guidance presented herein is based on published research, whilst Dalcon Environmental make every attempt to remain up to date, it is possible that scientific consensus may differ from that presented herein.

Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26282
Batch Number 150123145338	Sample ID SP3-S - PHYTO	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 18/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
123,159.0		673	7.7%
Species Name			
		Density	BioVolume
%			
<i>Bacillariophyceae</i>			
Bacteriastrum hyalinum		366	0.30
Cerataulina pelagica		366	0.30
Chaetoceros spp.		1,647	1.34
Cylindrotheca closterium		366	0.30
Nitzschia longissima		366	0.30
Proboscia alata		183	0.15
Pseudo-nitzschia "seriata group"		549	0.45
Rhizosolenia setigera		183	0.15
Thalassiothrix sp. 001		366	0.30
		4,392	0.0000
			3.57
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		116,937	94.95
		116,937	0.0000
			94.95
<i>Dinophyceae</i>			
Ceratium furca		366	0.30
Ceratium sp. 037		183	0.15
Dinophysis caudata var. pediculata		183	0.15
Protoperidinium grande		366	0.30
Protoperidinium sp. 018		549	0.45

Species Name	Density	BioVolume	%
Protoperidinium sp. 032	183		0.15
	1,830	0.0000	1.49

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26283
Batch Number 150123145338	Sample ID SP5-S - PHYTO	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 18/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
136,884.0		748	7.3%
Species Name			
		Density	BioVolume
%			
<i>Bacillariophyceae</i>			
Bacteriastrum hyalinum		183	0.13
Cerataulina pelagica		366	0.27
Chaetoceros spp.		1,281	0.94
Cylindrotheca closterium		183	0.13
Nitzschia longissima		366	0.27
Proboscia alata		183	0.13
Skeletonema costatum		549	0.40
Thalassiothrix sp. 001		549	0.40
		3,660	0.0000
			2.67
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		131,394	95.99
		131,394	0.0000
			95.99
<i>Dinophyceae</i>			
Ceratium furca		183	0.13
Ceratium sp. 040		183	0.13
Ceratium sp. 048		366	0.27
Dinophysis sp. 020		183	0.13
Prorocentrum sp. 005		183	0.13
Protoperidinium sp. 018		183	0.13

Species Name	Density	BioVolume	%
Protoperidinium sp. 046	183		0.13
Scrippsiella trochoidea	366		0.27
	1,830	0.0000	1.34

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26284
Batch Number 150123145338	Sample ID SP6-S - PHYTO	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 17/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
147,132.0		804	7.1%
Species Name			
		Density	BioVolume
%			
<i>Bacillariophyceae</i>			
Bacteriastrum hyalinum		549	0.37
Cerataulina pelagica		549	0.37
Chaetoceros spp.		3,843	2.61
Climacodium frauenfeldianum		732	0.50
Cylindrotheca closterium		366	0.25
Nitzschia longissima		549	0.37
Proboscia alata		366	0.25
Pseudo-nitzschia "delicatissima group"		2,196	1.49
Thalassiothrix sp. 001		3,843	2.61
		12,993	0.0000
			8.83
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		131,028	89.05
		131,028	0.0000
			89.05
<i>Dinophyceae</i>			
Ceratium furca		549	0.37
Ceratium sp. 040		183	0.12
Dinoflagellate 036		549	0.37
Dinophysis sp. 020		183	0.12
Gyrodinium sp. 016		183	0.12

Species Name	Density	BioVolume	%
Prorocentrum sp. 005	183		0.12
Protoperidinium sp. 018	549		0.37
Scrippsiella trochoidea	732		0.50
	3,111	0.0000	2.11

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

P// (08) 9271 6776

F// (08) 9248 9120

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26285
Batch Number 150123145338	Sample ID SP7-S - PHYTO	Date Collected 18/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 26/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
59,292.0		324	11.1%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrum hyalinum		183	0.31
Chaetoceros spp.		915	1.54
Leptocylindrus danicus		732	1.23
Pseudo-nitzschia "delicatissima group"		1,647	2.78
		3,477	0.0000
			5.86
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		55,083	92.90
		55,083	0.0000
			92.90
<i>Dinophyceae</i>			
Dinoflagellate 036		366	0.62
Gymnodinium sp. 024		183	0.31
Scrippsiella trochoidea		183	0.31
		732	0.0000
			1.23

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID Report Date 26/03/2015	DSID 26286
Batch Number 150123145338	Sample ID SP8-S - PHYTO	Date Collected 18/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 26/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes
Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
452,559.0		2,473	4.0%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrum hyalinum	2,379		0.53
Chaetoceros spp.	73,749		16.30
Climacodium sp. 002	183		0.04
Cylindrotheca closterium	183		0.04
Dactyliosolen phuketensis	183		0.04
Detonula sp. 001	1,281		0.28
Guinardia flaccida	549		0.12
Guinardia striata	366		0.08
Leptocylindrus danicus	366		0.08
Navicula transitrans var. derasa	183		0.04
Nitzschia longissima	1,098		0.24
Odontella sinensis	183		0.04
Proboscia alata	1,281		0.28
Pseudo-nitzschia "delicatissima group"	6,039		1.33
Pseudo-nitzschia "seriata group"	16,287		3.60
Rhizosolenia setigera	915		0.20
Rhizosolenia shrubsolei	183		0.04
Rhizosolenia striata	1,281		0.28
Skeletonema costatum	915		0.20
	107,604	0.0000	23.78

Species Name	Density	BioVolume	%
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	344,589		76.14
	344,589	0.0000	76.14
<i>Dinophyceae</i>			
Ceratium fusus	183		0.04
Prorocentrum sp. 005	183		0.04
	366	0.0000	0.08

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

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 Malaga, WA 6090

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26287
Batch Number 150123145338	Sample ID SP10-S - PHYTO	Date Collected 18/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 18/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes
Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
78,324.0		428	9.7%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Chaetoceros spp.	549		0.70
Cylindrotheca closterium	183		0.23
Entomoneis tenuistriata	183		0.23
Navicula spp.	183		0.23
Thalassiothrix sp. 001	549		0.70
	1,647	0.0000	2.10
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	75,579		96.50
	75,579	0.0000	96.50
<i>Dinophyceae</i>			
Ceratium sp. 039	183		0.23
Heterocapsa sp. 001	183		0.23
Katodinium rotundatum	183		0.23
Protoperidinium grande	366		0.47
Protoperidinium sp. 018	183		0.23
	1,098	0.0000	1.40

Species Name

Density

BioVolume

%

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26288
Batch Number 150123145338	Sample ID SP11-S - PHYTO	Date Collected 18/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 18/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes
Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
180,987.0		989	6.4%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Amphora sp. 008		183	0.10
Amphora sp. 074		183	0.10
Bacteriastrum hyalinum		2,013	1.11
Cerataulina pelagica		549	0.30
Chaetoceros spp.		2,379	1.31
Climacodium frauenfeldianum		549	0.30
Coscinodiscus spp.		366	0.20
Cylindrotheca closterium		183	0.10
Detonula sp. 001		549	0.30
Eucampia sp. 006		549	0.30
Guinardia striata		366	0.20
Hemiaulus sinensis		549	0.30
Leptocylindrus danicus		1,098	0.61
Nitzschia longissima		1,647	0.91
Odontella sinensis		183	0.10
Paralia sulcata		183	0.10
Planktoniella sol		366	0.20
Proboscia alata		183	0.10
Pseudo-nitzschia "delicatissima group"		3,843	2.12
Pseudo-nitzschia "seriata group"		4,209	2.33
Rhizosolenia setigera		183	0.10

Species Name	Density	BioVolume	%
Rhizosolenia shrubsolei	366		0.20
Rhizosolenia striata	915		0.51
Skeletonema costatum	549		0.30
Thalassionema frauenfeldii	3,477		1.92
Thalassionema nitzschioides	1,464		0.81
Thalassiothrix sp. 001	549		0.30
	27,633	0.0000	15.27
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	148,413		82.00
	148,413	0.0000	82.00
<i>Dinophyceae</i>			
Ceratium buceros	183		0.10
Ceratium furca	915		0.51
Ceratium lineatum	183		0.10
Ceratium sp. 031	183		0.10
Ceratium sp. 033	183		0.10
Ceratium sp. 048	183		0.10
Ornithocercus sp. 003	183		0.10
Prorocentrum micans	183		0.10
Protoperidinium crassipes	366		0.20
Protoperidinium grande	1,281		0.71
Protoperidinium roseum	183		0.10
Protoperidinium sp. 018	366		0.20
Protoperidinium steinii	366		0.20
Pyrophacus sp. 001	183		0.10
	4,941	0.0000	2.73

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26289
Batch Number 150123145338	Sample ID SP13-S - PHYTO	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 18/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
61,488.0		336	10.9%
Species Name			
		Density	BioVolume
%			
<i>Bacillariophyceae</i>			
Adoneis sp. 001		183	0.30
Chaetoceros spp.		1,281	2.08
Climacodium frauenfeldianum		366	0.60
Cylindrotheca closterium		366	0.60
Navicula transitrans var. derasa		183	0.30
Nitzschia longissima		366	0.60
		2,745	0.0000
			4.46
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		58,194	94.64
		58,194	0.0000
			94.64
<i>Dinophyceae</i>			
Ceratium sp. 036		183	0.30
Ornithocercus sp. 002		183	0.30
Phalacroma rotundatum		183	0.30
		549	0.0000
			0.89

End Of Report

Species Name

Density

BioVolume

%

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Shading Key

Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26290
Batch Number 150123145338	Sample ID SP14-S - PHYTO	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 17/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes
Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
178,608.0		976	6.4%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrum hyalinum		183	0.10
Cerataulina pelagica		549	0.31
Chaetoceros spp.		1,281	0.72
Guinardia striata		366	0.20
Leptocylindrus danicus		1,098	0.61
Proboscia alata		183	0.10
Pseudo-nitzschia "delicatissima group"		1,464	0.82
Rhizosolenia setigera		366	0.20
Rhizosolenia sp. 024		183	0.10
Skeletonema costatum		549	0.31
Thalassiothrix sp. 001		915	0.51
		7,137	0.0000
			4.00
<i>Cryptophyceae</i>			
Cryptophyte 004		366	0.20
		366	0.0000
			0.20
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		168,909	94.57
		168,909	0.0000
			94.57

Species Name	Density	BioVolume	%
<i>Dinophyceae</i>			
Dinoflagellate 036	549		0.31
Gymnodinium sp. 029	183		0.10
Heterocapsa sp. 001	183		0.10
Karenia papilionaceae	366		0.20
Prorocentrum micans	183		0.10
Protoperidinium roseum	183		0.10
Scrippsiella trochoidea	549		0.31
	2,196	0.0000	1.23

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26291
Batch Number 150123145338	Sample ID SP16-S - PHYTO	Date Collected 20/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 17/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
161,589.0		883	6.7%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Bacteriastrum hyalinum	183		0.11
Cerataulina pelagica	549		0.34
Chaetoceros spp.	2,013		1.25
Guinardia striata	366		0.23
Leptocylindrus danicus	1,281		0.79
Pseudo-nitzschia "delicatissima group"	2,196		1.36
Rhizosolenia setigera	549		0.34
Skeletonema costatum	549		0.34
Thalassiothrix sp. 001	2,013		1.25
	9,699	0.0000	6.00
<i>Cryptophyceae</i>			
Cryptophyte 004	183		0.11
	183	0.0000	0.11
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	149,145		92.30
	149,145	0.0000	92.30
<i>Dinophyceae</i>			
Dinoflagellate 036	915		0.57

Species Name	Density	BioVolume	%
Heterocapsa sp. 001	366		0.23
Karenia papilionaceae	549		0.34
Prorocentrum micans	183		0.11
Scrippsiella trochoidea	549		0.34
	2,562	0.0000	1.59

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

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Malaga, WA 6090

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 26/03/2015	DSID 26292
Batch Number 150123145338	Sample ID SP17-S - PHYTO	Date Collected 20/01/2015	
Monitoring Point Timor Sea	Sample Type Phytoplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 26/03/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
8,967.0		49	28.6%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Chaetoceros spp.		549	6.12
Nitzschia longissima		183	2.04
Nitzschia spp.		732	8.16
Proboscia alata		183	2.04
		1,647	0.0000
			18.37
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		6,405	71.43
		6,405	0.0000
			71.43
<i>Dinophyceae</i>			
Dinoflagellate 036		366	4.08
Gymnodinium sp. 009		183	2.04
Gymnodinium sp. 015		366	4.08
		915	0.0000
			10.20

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26293
Batch Number 150123150348	Sample ID SP1-S - ZOOP	Date Collected 20/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 26/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 60 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
375.0		375	10.3%
Species Name	Density	BioVolume	%
<i>Branchiopoda</i>			
Podonidae		2	0.53
Polyphemidae		1	0.27
		3	0.0000
			0.80
<i>Cladocera</i>			
Penilia avirostris		1	0.27
		1	0.0000
			0.27
<i>Copepoda</i>			
Acartiidae		3	0.80
Calanidae		55	14.67
Candacidae		3	0.80
Copepod Nauplius		27	7.20
Corycaeidae		5	1.33
Macrosetella sp. 001		2	0.53
Microsetella		2	0.53
Oncaeidae		7	1.87
Paracalanidae		3	0.80
Pontellidae nauplius		11	2.93
Sulcanidae		2	0.53
		120	0.0000
			32.00

Species Name	Density	BioVolume	%
Foraminifera			
Foraminiferida	4		1.07
	4	0.0000	1.07
Polycystinea			
Theoperidae	1		0.27
	1	0.0000	0.27
Sagittoidea			
Chaetognath	11		2.93
	11	0.0000	2.93
Trizonidae			
Trizonidae	233		62.13
	233	0.0000	62.13
Unknown			
Protozoa 047	2		0.53
	2	0.0000	0.53

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26294
Batch Number 150123150348	Sample ID SP3-S - ZOOP	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 28/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 61 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
145.0		145	16.6%
Species Name	Density	BioVolume	%
<i>Branchiopoda</i>			
Polyphemidae		1	0.69
		1	0.0000
			0.69
<i>Copepoda</i>			
Calanidae		17	11.72
Copepod Nauplius		17	11.72
Corycaeidae		7	4.83
Oncaeidae		1	0.69
Paracalanidae		5	3.45
Pontellidae nauplius		1	0.69
Sulcanidae		4	2.76
		52	0.0000
			35.86
<i>Polychaeta</i>			
Polychaete larva		1	0.69
		1	0.0000
			0.69
<i>Sagittoidea</i>			
Chaetognath		8	5.52
		8	0.0000
			5.52

Species Name	Density	BioVolume	%
<i>Trizonidae</i>			
Trizonidae	82		56.55
	82	0.0000	56.55
<i>Unknown</i>			
Protozoa 047	1		0.69
	1	0.0000	0.69

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

P// (08) 9271 6776

F// (08) 9248 9120

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26295
Batch Number 150123150348	Sample ID SP5-S - ZOOP	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 28/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 67 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
102.0		102	19.8%
Species Name	Density	BioVolume	%
<i>Copepoda</i>			
Acartiidae		9	8.82
Calanidae		59	57.84
Candacidae		1	0.98
Copepod Nauplius		6	5.88
Corycaeidae		4	3.92
Macrosetella sp. 001		3	2.94
Microsetella		11	10.78
Oncaeidae		1	0.98
Paracalanidae		3	2.94
Sulcanidae		1	0.98
		98	0.0000
			96.08
<i>Sagittoidea</i>			
Chaetognath		4	3.92
		4	0.0000
			3.92

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

P// (08) 9271 6776

F// (08) 9248 9120

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26296
Batch Number 150123150348	Sample ID SP6-S - ZOOP	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 28/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 3
Total volume of sample = 121 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
61.0		61	25.6%
Species Name	Density	BioVolume	%
<i>Branchiopoda</i>			
Polyphemidae		2	3.28
		2	0.0000
			3.28
<i>Copepoda</i>			
Acartiidae		1	1.64
Calanidae		15	24.59
Copepod Nauplius		21	34.43
Corycaeidae		10	16.39
Microsetella		4	6.56
Oncaeidae		3	4.92
		54	0.0000
			88.52
<i>Polycystinea</i>			
Theoperidae		5	8.20
		5	0.0000
			8.20

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26297
Batch Number 150123150348	Sample ID SP7-S - ZOOP	Date Collected 18/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 28/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 90 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
115.0		115	18.7%
Species Name			
		Density	BioVolume
%			
<i>Copepoda</i>			
Acartiidae		1	0.87
Calanidae		3	2.61
Copepod Nauplius		6	5.22
Corycaeidae		2	1.74
Microsetella		1	0.87
Oncaeidae		2	1.74
Pontellidae nauplius		1	0.87
Sulcanidae		3	2.61
		19	0.0000
			16.52
<i>Foraminifera</i>			
Foraminiferida		1	0.87
		1	0.0000
			0.87
<i>Gastropoda</i>			
Cavolinidae		3	2.61
		3	0.0000
			2.61
<i>Gigartacontidae</i>			
Gigartacontidae		2	1.74
		2	0.0000
			1.74

Species Name	Density	BioVolume	%
Ophiuroidea			
Echinoderm Ophiopluteus Larva	2		1.74
	2	0.0000	1.74
Polycystinea			
Theoperidae	2		1.74
	2	0.0000	1.74
Sagittoidea			
Chaetognath	2		1.74
	2	0.0000	1.74
Trizonidae			
Trizonidae	82		71.30
	82	0.0000	71.30
Unknown			
Protozoa 047	2		1.74
	2	0.0000	1.74

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26298
Batch Number 150123150348	Sample ID SP8-S - ZOOP	Date Collected 18/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 26/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 125 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
188.0		188	14.6%
Species Name	Density	BioVolume	%
<i>Copepoda</i>			
Calanidae		2	1.06
Copepod Nauplius		5	2.66
Macrosetella sp. 001		2	1.06
Microsetella		1	0.53
Oncaeidae		5	2.66
		15	0.0000
			7.98
<i>Gigartacontidae</i>			
Gigartacontidae		9	4.79
		9	0.0000
			4.79
<i>Ophiuroidea</i>			
Echinoderm Ophiopluteus Larva		1	0.53
		1	0.0000
			0.53
<i>Polychaeta</i>			
Polychaete larva		5	2.66
		5	0.0000
			2.66
<i>Polycystinea</i>			
Theoperidae		3	1.60

Species Name	Density	BioVolume	%
	3	0.0000	1.60
<i>Sagittoidea</i>			
Chaetognath	12		6.38
	12	0.0000	6.38
<i>Trizonidae</i>			
Trizonidae	142		75.53
	142	0.0000	75.53
<i>Unknown</i>			
Protozoa 047	1		0.53
	1	0.0000	0.53

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID Report Date 29/03/2015	DSID 26299
Batch Number 150123150348	Sample ID SP10-S - ZOOP	Date Collected 18/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 29/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 55 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
48,129.0		263	12.3%
Species Name	Density	BioVolume	%
<i>Copepoda</i>			
Acartiidae	549		1.14
Calanidae	4,575		9.51
Copepod Nauplius	3,660		7.60
Corycaeidae	2,013		4.18
Oncaeidae	915		1.90
Pontellidae nauplius	366		0.76
Sulcanidae	1,281		2.66
	13,359	0.0000	27.76
<i>Ophiuroidea</i>			
Echinoderm Ophiopluteus Larva	549		1.14
	549	0.0000	1.14
<i>Polychaeta</i>			
Polychaete larva	366		0.76
	366	0.0000	0.76
<i>Polycystinea</i>			
Theoperidae	32,208		66.92
	32,208	0.0000	66.92

Species Name	Density	BioVolume	%
<i>Sagittoidea</i>			
Chaetognath	1,647		3.42
	1,647	0.0000	3.42

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26300
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Batch Number 150123150348	Sample ID SP11-S - ZOOP	Date Collected 18/01/2015
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 26/03/2015
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 400 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
78.0		78	22.6%
Species Name	Density	BioVolume	%
<i>Copepoda</i>			
Acartiidae	1		1.28
Calanidae	1		1.28
Copepod Nauplius	37		47.44
Sulcanidae	1		1.28
	40	0.0000	51.28
<i>Foraminifera</i>			
Foraminiferida	3		3.85
	3	0.0000	3.85
<i>Gastropoda</i>			
Cavolinidae	1		1.28
	1	0.0000	1.28
<i>Gigartacotidae</i>			
Gigartacotidae	1		1.28
	1	0.0000	1.28
<i>Sagittoidea</i>			
Chaetognath	2		2.56
	2	0.0000	2.56

Species Name	Density	BioVolume	%
<i>Spirotrichea</i>			
Tintinnid	3		3.85
	3	0.0000	3.85
<i>Trizonidae</i>			
Trizonidae	27		34.62
	27	0.0000	34.62
<i>Unknown</i>			
Protozoa 047	1		1.28
	1	0.0000	1.28

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26301
Batch Number 150123150348	Sample ID SP13-S - ZOOP	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 29/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 80 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
549.0		549	8.5%
Species Name	Density	BioVolume	%
<i>Copepoda</i>			
Acartiidae	62		11.29
Calanidae	14		2.55
Candacidae	1		0.18
Copepod Nauplius	29		5.28
Corycaeidae	5		0.91
Macrosetella sp. 001	1		0.18
Microsetella	4		0.73
Oncaeidae	3		0.55
Sulcanidae	5		0.91
	124	0.0000	22.59
<i>Gastropoda</i>			
Cavoliniidae	2		0.36
	2	0.0000	0.36
<i>Malacostraca</i>			
Anomuran zoea larva	1		0.18
	1	0.0000	0.18
<i>Maxillopoda</i>			
Cirripede nauplius	1		0.18

Species Name	Density	BioVolume	%
	1	0.0000	0.18
<i>Ophiuroidea</i>			
Echinoderm Ophiopluteus Larva	2		0.36
	2	0.0000	0.36
<i>Sagittoidea</i>			
Chaetognath	7		1.28
	7	0.0000	1.28
<i>Trizonidae</i>			
Trizonidae	411		74.86
	411	0.0000	74.86
<i>Unknown</i>			
Protozoa 047	1		0.18
	1	0.0000	0.18

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26302
Batch Number 150123150348	Sample ID SP14-S - ZOOP	Date Collected 19/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 29/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 90 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
383.0		383	10.2%
Species Name	Density	BioVolume	%
<i>Copepoda</i>			
Acartiidae	18		4.70
Calanidae	3		0.78
Copepod Nauplius	38		9.92
Corycaeidae	4		1.04
Macrosetella sp. 001	3		0.78
Microsetella	2		0.52
Oncaeidae	2		0.52
Sulcanidae	1		0.26
	71	0.0000	18.54
<i>Gastropoda</i>			
Cavoliniidae	2		0.52
	2	0.0000	0.52
<i>Sagittoidea</i>			
Chaetognath	22		5.74
	22	0.0000	5.74
<i>Trizonidae</i>			
Trizonidae	288		75.20
	288	0.0000	75.20

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 29/03/2015	DSID 26303
Batch Number 150123150348	Sample ID SP17-S - ZOOP	Date Collected 20/01/2015	
Monitoring Point Timor Sea	Sample Type Zooplankton	Date Received 23/01/2015	
Functional Location ID Timor Sea	Method (Detection Limit) Raw Count (1)	Analysis Date 28/03/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Sample analysed diluted 10x
Number of chambers (1 ml) counted = 1
Total volume of sample = 68 ml

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
69.0		69	24.1%
Species Name	Density	BioVolume	%
<i>Branchiopoda</i>			
Polyphemidae		1	1.45
		1	0.0000
			1.45
<i>Copepoda</i>			
Acartiidae		1	1.45
Calanidae		4	5.80
Copepod Nauplius		28	40.58
Corycaeidae		1	1.45
Macrosetella sp. 001		1	1.45
Microsetella		1	1.45
Oncaeidae		1	1.45
Pontellidae nauplius		1	1.45
		38	0.0000
			55.07
<i>Foraminifera</i>			
Foraminiferida		2	2.90
		2	0.0000
			2.90
<i>Sagittoidea</i>			
Chaetognath		5	7.25
		5	0.0000
			7.25

Species Name	Density	BioVolume	%
<i>Trizonidae</i>			
Trizonidae	23		33.33
	23	0.0000	33.33

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Appendix C1. Autumn



Environmental

CERTIFICATE OF ANALYSIS

Work Order	: EP1502864	Page	: 1 of 14
Client	: JACOBS GROUP (AUSTRALIA) PTY LTD	Laboratory	: Environmental Division Perth
Contact	: MR CHRIS TEASDALE	Contact	: Scott James
Address	: P O BOX H615 PERTH WA, AUSTRALIA 6001	Address	: 10 Hod Way Malaga WA Australia 6090
E-mail	: cteasdale@globalism.com	E-mail	: perth.enviro.services@alsglobal.com
Telephone	: +61 08 9469 4400	Telephone	: +61-8-9209 7655
Facsimile	: +61 08 9469 4488	Facsimile	: +61-8-9209 7600
Project	: COP Barossa Env't I Studies Trip 4 IW021200	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: IW021200.104	Date Samples Received	: 16-APR-2015
C-O-C number	: ----	Issue Date	: 24-APR-2015
Sampler	: AC	No. of samples received	: 54
Site	: ----	No. of samples analysed	: 54
Quote number	: EP/286/15		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.



Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	Position	Accreditation Category
Rassem Ayoubi	Senior Organic Chemist	Perth Organics



Page : 2 of 14
Work Order : EP1502864
Client : JACOBS GROUP (AUSTRALIA) PTY LTD
Project : COP Barossa Env't Studies Trip 4 IW021200

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP1-S	SP1-M	SP1-B	SP2-S	SP2-M
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20		12-APR-2015 16:45	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50		12-APR-2015 16:45	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100		12-APR-2015 16:45	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50		12-APR-2015 16:45	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50		12-APR-2015 16:45	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20		12-APR-2015 16:45	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20		12-APR-2015 16:45	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100		12-APR-2015 16:45	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100		12-APR-2015 16:45	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100		12-APR-2015 16:45	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100		12-APR-2015 16:45	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100		12-APR-2015 16:45	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	12-APR-2015 16:45	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	12-APR-2015 16:45	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	12-APR-2015 16:45	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	µg/L	12-APR-2015 16:45	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	12-APR-2015 16:45	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	12-APR-2015 16:45	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	µg/L	12-APR-2015 16:45	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	12-APR-2015 16:45	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%	12-APR-2015 16:45	82.8	99.3	100	96.4	89.0
Toluene-D8	2037-26-5	0.1	%	12-APR-2015 16:45	109	102	104	104	106
4-Bromofluorobenzene	460-00-4	0.1	%	12-APR-2015 16:45	94.8	98.6	93.4	90.6	90.9



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP2-B	SP3-S	SP3-M	SP3-B	SP4-S
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20		12-APR-2015 18:00	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50		12-APR-2015 18:00	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100		12-APR-2015 18:00	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50		12-APR-2015 18:00	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50		12-APR-2015 18:00	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20		12-APR-2015 18:00	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20		12-APR-2015 18:00	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100		12-APR-2015 18:00	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100		12-APR-2015 18:00	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100		12-APR-2015 18:00	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100		12-APR-2015 18:00	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100		12-APR-2015 18:00	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	13-APR-2015 10:10	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	13-APR-2015 10:10	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	13-APR-2015 10:10	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	µg/L	13-APR-2015 10:10	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	13-APR-2015 10:10	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	13-APR-2015 10:10	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	µg/L	13-APR-2015 10:10	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	13-APR-2015 10:10	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%	13-APR-2015 10:10	98.7	102	99.9	99.8	97.8
Toluene-D8	2037-26-5	0.1	%	13-APR-2015 10:10	103	101	104	102	104
4-Bromofluorobenzene	460-00-4	0.1	%	13-APR-2015 10:10	91.5	91.9	92.7	90.6	90.0



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP4-M	SP4-B	SP5-S	SP5-M	SP5-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	97.4	84.7	82.4	88.0	82.7	82.7	82.7
Toluene-D8	2037-26-5	0.1	104	110	110	107	110	110	110
4-Bromofluorobenzene	460-00-4	0.1	90.2	98.7	95.9	97.2	93.8	93.8	93.8



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP6-S	SP6-M	SP6-B	SP7-S	SP7-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20			<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50			<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100			<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50			<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50			<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20			<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20			<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100			<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100			<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100			<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100			<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100			<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1			<1	<1	<1	<1	<1
Toluene	108-88-3	2			<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2			<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2			<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2			<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2			<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1			<1	<1	<1	<1	<1
Naphthalene	91-20-3	5			<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%		91.6	87.9	85.6	88.7	92.6
Toluene-D8	2037-26-5	0.1	%		106	108	109	107	107
4-Bromofluorobenzene	460-00-4	0.1	%		94.7	94.5	93.4	91.7	96.5



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP8-S	SP8-M	SP8-B	SP9-S	SP9-M
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20			<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50			<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100			<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50			<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50			<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20			<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20			<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100			<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100			<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100			<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100			<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100			<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1			<1	<1	<1	<1	<1
Toluene	108-88-3	2			<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2			<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2			<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2			<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2			<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1			<1	<1	<1	<1	<1
Naphthalene	91-20-3	5			<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1		%	87.5	87.0	90.2	88.0	83.6
Toluene-D8	2037-26-5	0.1		%	106	105	104	106	106
4-Bromofluorobenzene	460-00-4	0.1		%	97.5	93.6	93.8	93.3	90.4



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Unit	Client sample ID					
				SP9-B	SP10-S	SP10-M	SP10-B	SP11-S	
			Client sampling date / time						
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	µg/L	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	µg/L	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	µg/L	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	µg/L	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	µg/L	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	µg/L	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%	84.6	87.3	88.3	88.4	91.6	91.6
Toluene-D8	2037-26-5	0.1	%	107	104	106	105	104	104
4-Bromofluorobenzene	460-00-4	0.1	%	92.4	93.3	92.4	92.9	93.0	93.0



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP11-B	SP12-S	SP12-M	SP12-B	SP13-S
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20			<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50			<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100			<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50			<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50			<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20			<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20			<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100			<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100			<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100			<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100			<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100			<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1			<1	<1	<1	<1	<1
Toluene	108-88-3	2			<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2			<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2			<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2			<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2			<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1			<1	<1	<1	<1	<1
Naphthalene	91-20-3	5			<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1		%	89.5	85.5	89.8	89.0	86.4
Toluene-D8	2037-26-5	0.1		%	106	106	105	108	105
4-Bromofluorobenzene	460-00-4	0.1		%	90.7	89.8	92.4	88.7	89.0



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP13-M	SP13-B	SP14-S	SP14-M	SP14-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	88.9	86.5	81.8	92.9	89.4	89.4	89.4
Toluene-D8	2037-26-5	0.1	105	107	108	103	106	106	106
4-Bromofluorobenzene	460-00-4	0.1	89.8	89.8	87.7	91.1	87.2	87.2	87.2



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Compound	CAS Number	LOR	Client sample ID		SP15-S	SP15-M	SP15-B	SP16-S	SP16-B
			Client sampling date / time	Unit					
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	-----	20	<20	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	<100	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	<50	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	<50	<50	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	<100	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	<100	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	<100	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	-----	1	<1	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	<5	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	98.4	90.7	93.2	99.4	99.4	97.5	97.5
Toluene-D8	2037-26-5	0.1	98.9	103	101	99.4	99.4	101	101
4-Bromofluorobenzene	460-00-4	0.1	95.6	93.7	92.1	93.2	93.2	92.8	92.8



Page : 12 of 14
 Work Order : EP1502864
 Client : JACOBS GROUP (AUSTRALIA) PTY LTD
 Project : COP Barossa Env't Studies Trip 4 IW021200

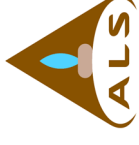
Analytical Results

Sub-Matrix: WATER (Matrix: WATER)	Client sample ID		SP17-S	SP17-M	SP17-B	FIELD BLANK	TRANS BLANK		
Compound	CAS Number	LOR	Client sampling date / time	Unit	SP17-S	SP17-M	SP17-B	FIELD BLANK	TRANS BLANK
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	<20	µg/L	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	<50	µg/L	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	<100	µg/L	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	<50	µg/L	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	<50	µg/L	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	<20	µg/L	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	<20	µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	<100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	<100	µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	<100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	<100	µg/L	<100	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	<100	µg/L	<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	<1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	<2	µg/L	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	<2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	<2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	<2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	<2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	<1	µg/L	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	<5	µg/L	<5	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	102	%	100	100	104	102	98.9
Toluene-D8	2037-26-5	0.1	97.6	%	98.7	98.7	97.1	97.1	98.9
4-Bromofluorobenzene	460-00-4	0.1	93.7	%	90.5	90.5	93.7	93.4	90.9



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)	Client sample ID		Client sampling date / time				
Compound	CAS Number	LOR	Unit	SP9-S LAB BLANK	SP8-M LAB BLANK	SP12-S LAB BLANK	SP11-S LAB BLANK
EP080/071: Total Petroleum Hydrocarbons							
C6 - C9 Fraction	-----	20	µg/L	<20	<20	<20	<20
C10 - C14 Fraction	-----	50	µg/L	<50	<50	<50	<50
C15 - C28 Fraction	-----	100	µg/L	<100	<100	<100	<100
C29 - C36 Fraction	-----	50	µg/L	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	-----	50	µg/L	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	<100	<100
>C16 - C34 Fraction	-----	100	µg/L	<100	<100	<100	<100
>C34 - C40 Fraction	-----	100	µg/L	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	-----	100	µg/L	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	-----	100	µg/L	<100	<100	<100	<100
EP080: BTEXN							
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2
meta- & para-Xylene	108-38-3	2	µg/L	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	<2
^ Sum of BTEX	-----	1	µg/L	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5
EP080S: TPH(V)/BTEX Surrogates							
1,2-Dichloroethane-D4	17060-07-0	0.1	%	90.3	90.3	103	103
Toluene-D8	2037-26-5	0.1	%	102	101	97.9	98.4
4-Bromofluorobenzene	460-00-4	0.1	%	85.8	86.8	90.4	90.2



Page : 14 of 14
Work Order : EP1502864
Client : JACOBS GROUP (AUSTRALIA) PTY LTD
Project : COP Barossa Env't Studies Trip 4 IW021200

Surrogate Control Limits

Sub-Matrix: WATER			
Compound	CAS Number	Recovery Limits (%)	
		Low	High
EP080S: TPH(V)/BTX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	60.5	141.2
Toluene-D8	2037-26-5	73.4	126
4-Bromofluorobenzene	460-00-4	59.6	125.3



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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD SAMPLE CODE	Sampling Date	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	3000 CHLOROPHYLL'a µg/L	3000 PHAEOPHYTIN'a µg/L	File
SP1-S	12/04/2015	<3	2	<2	11	90	<0.1	<0.2	15042201
SP1-M	12/04/2015	<3	33	200	40	280	<0.1	<0.2	15042301
SP1-B	12/04/2015	<3	60	360	65	450	<0.1	<0.2	
SP2-S	12/04/2015	<3	2	<2	12	90	<0.1	<0.2	
SP2-M	12/04/2015	<3	26	150	33	230	<0.1	<0.2	
SP2-B	12/04/2015	<3	58	360	63	450	<0.1	<0.2	
SP3-S	13/04/2015	<3	<2	<2	12	80	<0.1	<0.2	
SP3-M	13/04/2015	<3	31	190	41	310	<0.1	<0.2	
SP3-B	13/04/2015	<3	61	360	65	450	<0.1	<0.2	
SP4-S	13/04/2015	<3	2	<2	12	80	<0.1	<0.2	
SP4-M	13/04/2015	<3	27	140	34	220	<0.1	<0.2	
SP4-B	13/04/2015	<3	54	320	58	410	<0.1	<0.2	
SP5-S	13/04/2015	<3	2	<2	12	80	<0.1	<0.2	
SP5-M	13/04/2015	<3	26	120	34	220	<0.1	<0.2	
SP5-B	13/04/2015	<3	53	320	58	420	<0.1	<0.2	
SP6-S	13/04/2015	<3	2	<2	12	100	<0.1	<0.2	
SP6-M	13/04/2015	<3	33	200	39	290	<0.1	<0.2	
SP6-B	13/04/2015	<3	59	350	64	440	<0.1	<0.2	
SP7-S	13/04/2015	<3	2	<2	12	90	<0.1	<0.2	
SP7-B	13/04/2015	<3	2	<2	12	80	0.2	<0.2	

All test items tested as received. Spare test items will be held for two months unless otherwise requested.

Jamie Woodward

Signatory: Jamie Woodward
Date: 15/05/2015

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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

WATER QUALITY DATA

Date of issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

METHOD SAMPLE CODE	Sampling Date	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	3000 CHLOROPHYLL'a µg/L	3000 PHAEOPHYTIN'a µg/L	File
SP8-S	14/04/2015	<3	<2	<2	12	90	0.3	<0.2	15042301
SP8-M	14/04/2015	<3	2	<2	12	100	<0.1	<0.2	
SP8-B	14/04/2015	<3	3	2	12	80	0.2	<0.2	
SP9-S	14/04/2015	<3	3	<2	12	80	0.2	<0.2	
SP9-M	14/04/2015	<3	3	<2	12	80	0.2	<0.2	
SP9-B	14/04/2015	<3	24	110	31	200	<0.1	<0.2	
SP10-S	13/04/2015	<3	2	<2	12	100	<0.1	<0.2	
SP10-M	13/04/2015	<3	15	64	24	160	0.3	<0.2	
SP10-B	13/04/2015	<3	53	310	57	420	<0.1	<0.2	
SP11-S	14/04/2015	<3	3	<2	13	80	<0.1	<0.2	
SP11-B	14/04/2015	<3	3	4	13	90	0.1	<0.2	
SP12-S	14/04/2015	<3	3	<2	12	80	<0.1	<0.2	
SP12-M	14/04/2015	<3	2	<2	13	90	0.1	<0.2	
SP12-B	14/04/2015	<3	17	74	28	180	0.2	<0.2	
SP13-S	14/04/2015	<3	2	<2	13	80	<0.1	<0.2	
SP13-M	14/04/2015	<3	3	<2	14	90	0.2	<0.2	
SP13-B	14/04/2015	<3	24	110	32	210	0.1	<0.2	
SP14-S	13/04/2015	<3	2	<2	13	90	<0.1	<0.2	
SP14-M	13/04/2015	<3	3	<2	13	90	0.3	<0.2	
SP14-B	13/04/2015	<3	26	120	33	220	0.1	<0.2	

All test items tested as received. Spare test items will be held for two months unless otherwise requested.

Jamie Woodward

Signatory: Jamie Woodward
Date: 15/05/2015

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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD SAMPLE CODE	Sampling Date	2000 AMMONIA µg.N/L	4100 ORTHO-P µg.P/L	2100 NO3+NO2 µg.N/L	4700 TOTAL-P µg.P/L	2700 TOTAL-N µg.N/L	3000 CHLOROPHYLL'a' µg/L	3000 PHAEOPHYTIN'a' µg/L	
Reporting Limit		<3	<2	<2	<5	<50	<0.1	<0.2	
File		15042201							15042301
SP15-S	12/04/2015	4	3	<2	12	90	<0.1	<0.2	
SP15-M	12/04/2015	<3	3	<2	14	120	0.2	<0.2	
SP15-B	12/04/2015	8	22	110	36	250	<0.1	<0.2	
SP16-S	12/04/2015	<3	2	<2	12	100	<0.1	<0.2	
SP16-B	12/04/2015	<3	2	<2	12	90	<0.1	<0.2	
SP17-S	12/04/2015	<3	2	<2	12	100	<0.1	<0.2	
SP17-M	12/04/2015	<3	5	7	14	100	0.3	<0.2	
SP17-B	12/04/2015	9	29	150	35	240	<0.1	<0.2	
Field Blank	14/04/2015	<3	<2	<2	<5	<50	<0.1	<0.2	
Trans Blank	14/04/2015	<3	<2	<2	<5	<50	<0.1	<0.2	

Signatory: Jamie Woodward
Date: 15/05/2015

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WATER QUALITY DATA

Date of Issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

METHOD	Sampling Date	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	Hg mg/L	ICP006
Reporting Limit		<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	
SP1-S	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.6	<0.1	5.4	<0.1	<0.0001	15042203-04
SP1-M	12/04/2015	0.2	<0.05	0.3	<0.2	1	1.8	<0.1	6.3	<0.1	<0.0001	
SP1-B	12/04/2015	0.2	<0.05	0.4	<0.2	<1	2.0	<0.1	7.9	<0.1	<0.0001	
SP2-S	12/04/2015	<0.2	<0.05	<0.3	0.2	1	1.7	<0.1	5.6	<0.1	<0.0001	
SP2-M	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.9	<0.1	5.7	<0.1	<0.0001	
SP2-B	12/04/2015	0.2	<0.05	0.4	<0.2	<1	1.9	<0.1	8.0	<0.1	<0.0001	
SP3-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.5	<0.1	<0.0001	
SP3-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.9	<0.1	6.0	<0.1	<0.0001	
SP3-B	13/04/2015	<0.2	<0.05	0.4	<0.2	<1	2.0	<0.1	8.1	<0.1	<0.0001	
SP4-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001	
SP4-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.6	<0.1	<0.0001	
SP4-B	13/04/2015	0.2	<0.05	0.3	<0.2	<1	1.8	<0.1	7.4	<0.1	<0.0001	
SP5-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.0	<0.1	<0.0001	
SP5-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	6.0	<0.1	<0.0001	
SP5-B	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	6.4	<0.1	<0.0001	
SP6-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.1	<0.1	<0.0001	
SP6-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.8	<0.1	5.7	<0.1	<0.0001	
SP6-B	13/04/2015	<0.2	<0.05	0.4	<0.2	<1	1.8	<0.1	7.5	<0.1	<0.0001	
SP7-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.1	<0.1	<0.0001	
SP7-B	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.3	<0.1	5.5	<0.1	<0.0001	

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Jamie Woodward
Signatory: Jamie Woodward
Date: 15/05/2015

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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD SAMPLE CODE	Reporting Limit	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	Hg mg/L	ICP006
SP8-S	<0.2	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	15042203-04
SP8-M	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.2	<0.1	<0.0001	
SP8-B	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.3	<0.1	<0.0001	
SP9-S	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.1	<0.1	<0.0001	
SP9-M	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.3	<0.1	<0.0001	
SP9-B	<0.2	<0.2	<0.05	<0.3	<0.2	1	1.8	<0.1	5.0	<0.1	<0.0001	
SP10-S	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.7	<0.1	<0.0001	
SP10-M	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.5	<0.1	<0.0001	
SP10-B	0.2	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001	
SP11-S	<0.2	<0.2	<0.05	0.4	<0.2	<1	1.9	<0.1	7.1	<0.1	<0.0001	
SP11--B	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.5	<0.1	<0.0001	
SP12-S	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.2	<0.1	<0.0001	
SP12-M	<0.2	<0.2	<0.05	<0.3	0.3	1	1.7	<0.1	5.2	<0.1	<0.0001	
SP12-B	<0.2	<0.2	<0.05	<0.3	0.2	1	1.7	<0.1	5.1	<0.1	<0.0001	
SP13-S	<0.2	<0.2	<0.05	<0.3	0.3	<1	1.8	<0.1	5.8	<0.1	<0.0001	
SP13-M	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.1	<0.1	<0.0001	
SP13-B	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.3	<0.1	<0.0001	
SP14-S	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	6.1	<0.1	<0.0001	
SP14-M	<0.2	<0.2	<0.05	<0.3	0.2	<1	1.7	<0.1	5.4	<0.1	<0.0001	
SP14-B	<0.2	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.7	<0.1	<0.0001	
			<0.05	<0.3	<0.2	<1	2.0	<0.1	6.2	<0.1	<0.0001	

Jamie Woodward

Signatory: Jamie Woodward
Date: 15/05/2015

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Environmental Science**

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measurements included in this document are
traceable to Australian/national standards.



Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

WATER QUALITY DATA

Date of Issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

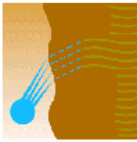
METHOD	Sampling Date	MS001 Filtered Cr µg/L	MS001 Filtered Co µg/L	MS001 Filtered Ni µg/L	MS001 Filtered Cu µg/L	MS001 Filtered Zn µg/L	MS001 Filtered As µg/L	MS001 Filtered Cd µg/L	MS001 Filtered Ba µg/L	MS001 Filtered Pb µg/L	Hg mg/L	ICP006
SP15-S	12/04/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001
SP15-M	12/04/2015	<0.2	<0.05	<0.3	<0.2	2	1.8	<0.1	5.5	<0.1	<0.0001	<0.0001
SP15-B	12/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.7	<0.1	<0.0001	<0.0001
SP16-S	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.9	<0.1	6.3	<0.1	<0.0001	<0.0001
SP16-B	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.4	<0.1	<0.0001	<0.0001
SP17-S	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.3	<0.1	<0.0001	<0.0001
SP17-M	12/04/2015	<0.2	<0.05	<0.3	<0.2	4	1.7	<0.1	5.6	<0.1	<0.0001	<0.0001
SP17-B	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.6	<0.1	<0.0001	<0.0001
Field Blank	14/04/2015	<0.2	<0.05	<0.3	<0.2	2	1.9	<0.1	6.3	<0.1	<0.0001	<0.0001
Trans Blank	14/04/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001
						<1	<0.5	<0.1	<0.5	<0.1	<0.0001	<0.0001

File 15042203-04

Signatory: Jamie Woodward
Date: 15/05/2015

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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	ICP006 Total Ext Hg mg/L
SAMPLE CODE		<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001
Reporting Limit											
SP1-S	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.9	<0.1	5.9	<0.1	<0.0001
SP1-M	12/04/2015	0.2	<0.05	0.3	0.2	2	1.9	<0.1	6.1	<0.1	<0.0001
SP1-B	12/04/2015	0.3	<0.05	0.4	<0.2	1	2.1	<0.1	8.0	<0.1	<0.0001
SP2-S	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.8	<0.1	5.5	<0.1	<0.0001
SP2-M	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.8	<0.1	5.8	<0.1	<0.0001
SP2-B	12/04/2015	0.2	<0.05	0.3	0.3	2	2.0	<0.1	8.1	<0.1	<0.0001
SP3-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.5	<0.1	<0.0001
SP3-M	13/04/2015	0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.9	<0.1	<0.0001
SP3-B	13/04/2015	0.2	<0.05	0.5	<0.2	<1	2.1	<0.1	8.2	<0.1	<0.0001
SP4-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001
SP4-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.6	<0.1	<0.0001
SP4-B	13/04/2015	0.2	<0.05	0.3	<0.2	<1	2.0	<0.1	7.5	<0.1	<0.0001
SP5-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.0	<0.1	<0.0001
SP5-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.8	<0.1	<0.0001
SP5-B	13/04/2015	<0.2	<0.05	0.3	<0.2	1	1.8	<0.1	6.7	<0.1	<0.0001
SP6-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.3	<0.1	<0.0001
SP6-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.8	<0.1	5.7	<0.1	<0.0001
SP6-B	13/04/2015	<0.2	<0.05	0.4	<0.2	<1	1.9	<0.1	7.6	<0.1	<0.0001
SP7-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.1	<0.1	<0.0001
SP7-B	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.5	<0.1	5.6	<0.1	<0.0001

File 15042201-03

Signatory: Jamie Woodward
Date: 15/05/2015

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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	ICP006 Total Ext Hg mg/L
SP8-S	14/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.6	<0.1	5.3	<0.1	<0.0001
SP8-M	14/04/2015	<0.2	<0.05	<0.3	0.2	<1	1.7	<0.1	5.5	<0.1	<0.0001
SP8-B	14/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.7	<0.1	5.3	<0.1	<0.0001
SP9-S	14/04/2015	<0.2	<0.05	<0.3	<0.2	2	1.7	<0.1	5.4	<0.1	<0.0001
SP9-M	14/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.2	<0.1	<0.0001
SP9-B	14/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.9	<0.1	5.9	<0.1	<0.0001
SP10-S	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.7	<0.1	5.5	<0.1	<0.0001
SP10-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.6	<0.1	<0.0001
SP10-B	13/04/2015	0.2	<0.05	0.4	0.2	<1	1.9	<0.1	7.4	<0.1	<0.0001
SP11-S	14/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.9	<0.1	5.3	<0.1	<0.0001
SP11--B	14/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.2	<0.1	<0.0001
SP12-S	14/04/2015	<0.2	<0.05	<0.3	0.3	2	1.6	<0.1	5.2	<0.1	<0.0001
SP12-M	14/04/2015	<0.2	<0.05	<0.3	0.3	<1	1.6	<0.1	5.1	<0.1	<0.0001
SP12-B	14/04/2015	<0.2	<0.05	<0.3	0.3	<1	1.8	<0.1	5.8	<0.1	<0.0001
SP13-S	14/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.6	<0.1	5.2	<0.1	<0.0001
SP13-M	14/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.6	<0.1	5.3	<0.1	<0.0001
SP13-B	14/04/2015	<0.2	<0.05	<0.3	0.3	<1	1.8	<0.1	6.1	<0.1	<0.0001
SP14-S	13/04/2015	<0.2	<0.05	<0.3	0.2	<1	1.7	<0.1	5.5	<0.1	<0.0001
SP14-M	13/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.5	<0.1	<0.0001
SP14-B	13/04/2015	<0.2	<0.05	<0.3	<0.2	1	2.0	<0.1	6.2	<0.1	<0.0001

File 15042201-03

Jamie Woodward

Signatory: Jamie Woodward
Date: 15/05/2015

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Contact: Celeste Wilson
Customer: Jacobs
Address: Level 11, Durack Centre, 263 Adelaide Terrace, Perth WA 6001

Date of Issue: 15/05/2015
Date Received: 16/04/2015
Our Reference: JAC15-6
Your Reference: IW021200.104

WATER QUALITY DATA

METHOD	Sampling Date	MS001 Unfiltered Cr µg/L	MS001 Unfiltered Co µg/L	MS001 Unfiltered Ni µg/L	MS001 Unfiltered Cu µg/L	MS001 Unfiltered Zn µg/L	MS001 Unfiltered As µg/L	MS001 Unfiltered Cd µg/L	MS001 Unfiltered Ba µg/L	MS001 Unfiltered Pb µg/L	ICP006 Total Ext Hg mg/L
SP15-S	12/04/2015	<0.2	<0.05	<0.3	<0.2	3	1.7	<0.1	5.5	<0.1	<0.0001
SP15-M	12/04/2015	<0.2	<0.05	<0.3	<0.2	<1	1.8	<0.1	5.7	<0.1	<0.0001
SP15-B	12/04/2015	<0.2	<0.05	<0.3	0.2	1	1.9	<0.1	6.3	<0.1	<0.0001
SP16-S	12/04/2015	<0.2	<0.05	<0.3	0.2	1	1.9	<0.1	5.5	<0.1	<0.0001
SP16-B	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.9	<0.1	5.6	<0.1	<0.0001
SP17-S	12/04/2015	<0.2	<0.05	<0.3	0.2	3	1.8	<0.1	5.6	<0.1	<0.0001
SP17-M	12/04/2015	<0.2	<0.05	<0.3	<0.2	3	1.7	<0.1	5.6	<0.1	<0.0001
SP17-B	12/04/2015	<0.2	<0.05	<0.3	<0.2	1	1.9	<0.1	6.2	<0.1	<0.0001
Field Blank	14/04/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001
Trans Blank	14/04/2015	<0.2	<0.05	<0.3	<0.2	<1	<0.5	<0.1	<0.5	<0.1	<0.0001

File **15042201-03**

Signatory: Jamie Woodward
Date: 15/05/2015

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WORLD RECOGNISED
ACCREDITATION

Accredited Laboratory
No. 14174

3 June 2015

Ref: 9278
Contract: MW 1739
Page 1 of 3

Sinclair Knight Merz – JACOBS PROJECT
7th Floor Durack Centre
PERTH WA 6000

Attn: Alaina Clark/Marine Scientist

ANALYTICAL REPORT

The results (to 95%, 2σ confidence level) for Radium-226, Radium-228 and Thorium-228 analyses of forty eight (48) liquid samples, as received at our laboratory on 29 April 2015, are detailed on page two and three of this report.

MDL:	Radium-226	0.100 Bq/l	Radium-228	0.100 Bq/l
	Thorium-228	0.100 Bq/l		

Method:	LTP No. 4(a)	Gamma Spectrometry Analysis
----------------	--------------	-----------------------------


Madassar A. Qureshi
Authorised Signatory

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WRS No	Client Sample ID	Ra-226 (Bq/l)	Ra-228 (Bq/l)	Th-228 (Bq/l)
9278-1	SP1-S	<MDL	<MDL	<MDL
9278-2	SP1-M	<MDL	<MDL	<MDL
9278-3	SP1-B	<MDL	<MDL	<MDL
9278-4	SP2-S	<MDL	<MDL	<MDL
9278-5	SP2-M	0.124 ± 0.014	<MDL	<MDL
9278-6	SP2-B	<MDL	<MDL	<MDL
9278-7	SP3-S	<MDL	<MDL	<MDL
9278-8	SP3-M	<MDL	<MDL	<MDL
9278-9	SP3-B	<MDL	<MDL	<MDL
9278-10	SP4-S	0.295 ± 0.053	0.148 ± 0.045	<MDL
9278-10D	SP4-S	0.263 ± 0.049	0.165 ± 0.064	<MDL
9278-11	SP4-M	<MDL	<MDL	<MDL
9278-12	SP4-B	<MDL	<MDL	<MDL
9278-13	SP5-S	<MDL	<MDL	<MDL
9278-14	SP5-M	0.104 ± 0.014	<MDL	<MDL
9278-15	SP5-B	<MDL	<MDL	<MDL
9278-16	SP6-S	<MDL	<MDL	<MDL
9278-17	SP6-M	<MDL	<MDL	<MDL
9278-18	SP6-B	<MDL	<MDL	<MDL
9278-19	SP7-S	<MDL	<MDL	<MDL
9278-20	SP7-B	0.137 ± 0.024	<MDL	<MDL
9278-20D	SP7-B	0.141 ± 0.025	<MDL	<MDL
9278-21	SP8-S	0.136 ± 0.019	<MDL	<MDL
9278-22	SP8-M	<MDL	<MDL	<MDL
9278-23	SP8-B	<MDL	<MDL	<MDL
9278-24	SP9-S	0.113 ± 0.022	<MDL	<MDL
9278-25	SP9-M	<MDL	<MDL	<MDL
9278-26	SP9-B	<MDL	<MDL	<MDL



WRS No	Client Sample ID	Ra-226 (Bq/l)	Ra-228 (Bq/l)	Th-228 (Bq/l)
9278-27	SP10-S	<MDL	<MDL	<MDL
9278-28	SP10-M	<MDL	<MDL	<MDL
9278-29	SP10-B	<MDL	<MDL	<MDL
9278-30	SP11-S	0.136 ± 0.030	<MDL	<MDL
9278-30D	SP11-S	0.172 ± 0.031	<MDL	<MDL
9278-31	SP11-B	<MDL	<MDL	<MDL
9278-32	SP12-S	<MDL	<MDL	<MDL
9278-33	SP12-M	0.105 ± 0.015	<MDL	<MDL
9278-34	SP12-B	<MDL	<MDL	<MDL
9278-35	SP13-S	<MDL	<MDL	<MDL
9278-36	SP13-M	<MDL	<MDL	<MDL
9278-37	SP13-B	<MDL	<MDL	<MDL
9278-38	SP14-S	<MDL	<MDL	<MDL
9278-39	SP14-M	<MDL	<MDL	<MDL
9278-40	SP14-B	<MDL	<MDL	<MDL
9278-40D	SP14-B	<MDL	<MDL	<MDL
9278-41	SP15-S	<MDL	<MDL	<MDL
9278-42	SP15-M	<MDL	<MDL	<MDL
9278-43	SP15-B	<MDL	<MDL	<MDL
9278-44	SP16-S	<MDL	<MDL	<MDL
9278-45	SP16-B	<MDL	<MDL	<MDL
9278-46	SP17-S	<MDL	<MDL	<MDL
9278-47	SP17-M	<MDL	<MDL	<MDL
9278-48	SP17-B	<MDL	<MDL	<MDL

The reported expanded uncertainty of measurement is stated as the standard uncertainty of the measurement $\pm 5.6\%$, multiplied by the coverage factor $k=2$, which corresponds to a coverage probability of approximately 95%.

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

P// (08) 9271 6776

F// (08) 9248 9120

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27560
Batch Number 150420110337	Sample ID SP1-S	Date Collected 12/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP1-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 29/05/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
21,960.0		120	18.3%
Species Name	Density	BioVolume	%
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	20,130		91.67
	20,130	0.0000	91.67
<i>Dinophyceae</i>			
Dinoflagellate 003	183		0.83
Dinoflagellate 036	1,098		5.00
Gyrodinium sp. 002	183		0.83
Heterocapsa sp. 001	183		0.83
Scrippsiella trochoidea	183		0.83
	1,830	0.0000	8.33

End Of Report

This report contains coloured shading. Dalcon Environmental intends that this report be viewed and/or printed in colour.

Dalcon Environmental Pty Ltd makes no claim that the taxa list provided herein is exhaustive. Some taxa, including potentially problematic taxa, may be present in the sample but not recorded during analysis, this is particularly the case for small or inconspicuous taxa or taxa present in low numbers. Guidance presented herein is based on published research, whilst Dalcon Environmental make every attempt to remain up to date, it is possible that scientific consensus may differ from that presented herein.

Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

P// (08) 9271 6776

F// (08) 9248 9120

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27561
Batch Number 150420110513	Sample ID SP3-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP3-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
9,882.0		54	27.2%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Nitzschia spp.		183	1.85
		183	0.0000
			1.85
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		8,601	87.04
		8,601	0.0000
			87.04
<i>Dinophyceae</i>			
Dinoflagellate 003		183	1.85
Dinoflagellate 036		366	3.70
Dinoflagellate 081		183	1.85
Prorocentrum dentatum		183	1.85
Protoperidinium steinii		183	1.85
		1,098	0.0000
			11.11

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27562
Batch Number 150420110600	Sample ID SP5-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP5-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
5,856.0		32	35.4%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Navicula spp.		549	9.38
Nitzschia spp.		915	15.63
		1,464	0.0000
			25.00
<i>Chlorophyceae</i>			
Chlorophyte 002		2,928	50.00
		2,928	0.0000
			50.00
<i>Dinophyceae</i>			
Dinoflagellate 003		366	6.25
Dinoflagellate 036		732	12.50
Heterocapsa sp. 001		366	6.25
		1,464	0.0000
			25.00

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27563
Batch Number 150420110644	Sample ID SP6-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP6-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
6,222.0		34	34.3%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Chaetoceros spp.		549	8.82
Nitzschia spp.		183	2.94
		732	0.0000
			11.76
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		4,209	67.65
		4,209	0.0000
			67.65
<i>Dinophyceae</i>			
Dinoflagellate 003		183	2.94
Dinoflagellate 036		549	8.82
Dinoflagellate 081		183	2.94
Heterocapsa sp. 001		366	5.88
		1,281	0.0000
			20.59

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27564
Batch Number 150420110734	Sample ID SP7-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP7-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 29/05/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
8,601.0		47	29.2%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Chaetoceros spp.		366	4.26
		366	4.26
		0.0000	0.00
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		7,137	82.98
		7,137	82.98
		0.0000	0.00
<i>Dinophyceae</i>			
Dinoflagellate 003		549	6.38
Dinoflagellate 036		183	2.13
Heterocapsa sp. 001		183	2.13
Scrippsiella trochoidea		183	2.13
		1,098	12.77
		0.0000	0.00

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27565
Batch Number 150420110817	Sample ID SP8-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP8-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 29/05/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
4,941.0		27	38.5%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Chaetoceros spp.		366	7.41
Leptocylindrus danicus		183	3.70
Navicula spp.		366	7.41
		915	0.0000
			18.52
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		3,294	66.67
		3,294	0.0000
			66.67
<i>Dinophyceae</i>			
Dinoflagellate 003		366	7.41
Dinoflagellate 036		183	3.70
Gyrodinium sp. 002		183	3.70
		732	0.0000
			14.81

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27566
Batch Number 150420110901	Sample ID SP10-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP10-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
2,928.0		16	50.0%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Cylindrotheca closterium		183	6.25
Nitzschia spp.		183	6.25
		366	0.0000
			12.50
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		1,281	43.75
		1,281	0.0000
			43.75
<i>Dinophyceae</i>			
Dinoflagellate 003		549	18.75
Dinoflagellate 036		183	6.25
Heterocapsa sp. 001		183	6.25
Scrippsiella trochoidea		366	12.50
		1,281	0.0000
			43.75

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

DATA REPORT

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27567
Batch Number 150420110940	Sample ID SP11-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP11-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
2,745.0		15	51.6%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Chaetoceros spp.		549	20.00
Cylindrotheca closterium		183	6.67
Nitzschia spp.		549	20.00
		1,281	0.0000
			46.67
<i>Dinophyceae</i>			
Dinoflagellate 003		366	13.33
Dinoflagellate 036		549	20.00
Dinoflagellate 081		366	13.33
Gyrodinium sp. 002		183	6.67
		1,464	0.0000
			53.33

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27568
Batch Number 150420111019	Sample ID SP13-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP13-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
1,464.0		8	70.7%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Cylindrotheca closterium		366	25.00
Nitzschia spp.		183	12.50
		549	0.0000
			37.50
<i>Dinophyceae</i>			
Dinoflagellate 003		366	25.00
Dinoflagellate 036		183	12.50
Dinoflagellate 081		183	12.50
Gyrodinium sp. 002		183	12.50
		915	0.0000
			62.50

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

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Malaga, WA 6090

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27569
Batch Number 150420111058	Sample ID SP14-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP14-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
1,464.0		8	70.7%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Nitzschia spp.		183	12.50
		183	0.0000 12.50
<i>Cryptophyceae</i>			
Cryptophyte 014		183	12.50
		183	0.0000 12.50
<i>Dinophyceae</i>			
Dinoflagellate 003		183	12.50
Dinoflagellate 036		183	12.50
Dinoflagellate 081		549	37.50
Gyrodinium sp. 002		183	12.50
		1,098	0.0000 75.00

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27570
Batch Number 150420111139	Sample ID SP16-S	Date Collected 12/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP16-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
2,928.0		16	50.0%
Species Name	Density	BioVolume	%
<i>Cyanobacteria</i>			
Trichodesmium erythraeum	2,013	0.0000	68.75
	2,013	0.0000	68.75
<i>Dinophyceae</i>			
Dinoflagellate 003	549		18.75
Dinoflagellate 036	183		6.25
Heterocapsa sp. 001	183		6.25
	915	0.0000	31.25

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

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Malaga, WA 6090

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Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27571
Batch Number 150420111222	Sample ID SP17-S	Date Collected 12/04/2015	
Monitoring Point	Sample Type Phytoplankton	Date Received 20/04/2015	
Functional Location ID SP17-S	Method (Detection Limit) Utermohl Tube (New) (183)	Analysis Date 1/06/2015	
Units Reported Cell Density: cells L ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

No exceedances of WASQAP (2011) guideline values.

Field Data Recording

Total Density	cells L ⁻¹	Total Counted	Uncertainty
7,869.0		43	30.5%
Species Name	Density	BioVolume	%
<i>Bacillariophyceae</i>			
Chaetoceros spp.		549	6.98
Nitzschia spp.		366	4.65
		915	0.0000
			11.63
<i>Cyanobacteria</i>			
Trichodesmium erythraeum		5,673	72.09
		5,673	0.0000
			72.09
<i>Dinophyceae</i>			
Dinoflagellate 003		549	6.98
Dinoflagellate 036		366	4.65
Heterocapsa sp. 001		366	4.65
		1,281	0.0000
			16.28

End Of Report

Shading Key

Species Name

Density

BioVolume

%

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Potentially toxic species

Potentially harmful
(non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID Report Date 1/06/2015	DSID 27585
Batch Number 150420113150	Sample ID SP1-S	Date Collected 12/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP1-S	Method (Detection Limit) Raw Count (1)	Analysis Date 29/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 100 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
407.0		407	9.9%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian	11		2.70
	11	0.0000	2.70
<i>Copepoda</i>			
Acartiidae	34		8.35
Calanidae	157		38.57
Copepod Nauplius	101		24.82
Corycaeidae	47		11.55
Macrosetella sp. 001	5		1.23
Microsetella	3		0.74
Oncaeidae	10		2.46
Paracalanidae	2		0.49
Pontellidae nauplius	14		3.44
Sulcanidae	6		1.47
	379	0.0000	93.12
<i>Polychaeta</i>			
Polychaete larva	14		3.44
	14	0.0000	3.44
<i>Sagittoidea</i>			

Species Name	Density	BioVolume	%
Chaetognath	1		0.25
	1	0.0000	0.25
<i>Unknown</i>			
Protozoa 047	1		0.25
Protozoa 056	1		0.25
	2	0.0000	0.49

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27586
Batch Number 150420113235	Sample ID SP3-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP3-S	Method (Detection Limit) Raw Count (1)	Analysis Date 28/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 106 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
3,188.0		3,188	3.5%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		9	0.28
		9	0.0000
			0.28
<i>Copepoda</i>			
Acartiidae		13	0.41
Calanidae		2	0.06
Copepod Nauplius		9	0.28
Corycaeidae		15	0.47
Oncaeidae		3	0.09
Sulcanidae		1	0.03
		43	0.0000
			1.35
<i>Foraminifera</i>			
Foraminiferida		3	0.09
		3	0.0000
			0.09
<i>Gigartacontidae</i>			
Gigartacontidae		3,126	98.06
		3,126	0.0000
			98.06
<i>Polychaeta</i>			

Species Name	Density	BioVolume	%
Polychaete larva	1		0.03
	1	0.0000	0.03
<i>Sagittoidea</i>			
Chaetognath	4		0.13
	4	0.0000	0.13
<i>Unknown</i>			
Protozoa 047	2		0.06
	2	0.0000	0.06

End Of Report

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

P// (08) 9271 6776

F// (08) 9248 9120

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27587
Batch Number 150420113313	Sample ID SP5-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP5-S	Method (Detection Limit) Raw Count (1)	Analysis Date 28/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 86 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
2,807.0		2,807	3.8%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian	17		0.61
	17	0.0000	0.61
<i>Copepoda</i>			
Acartiidae	103		3.67
Calanidae	333		11.86
Copepod Nauplius	151		5.38
Corycaeidae	55		1.96
Macrosetella sp. 001	12		0.43
Microsetella	16		0.57
Oncaeidae	56		2.00
Paracalanidae	15		0.53
Pontellidae nauplius	22		0.78
Sulcanidae	31		1.10
	794	0.0000	28.29
<i>Foraminifera</i>			
Foraminiferida	2		0.07
	2	0.0000	0.07
<i>Gigartacotidae</i>			

Species Name	Density	BioVolume	%
<i>Gigartacontidae</i>	1,974		70.32
	1,974	0.0000	70.32
<i>Sagittoidea</i>			
Chaetognath	12		0.43
	12	0.0000	0.43
<i>Unknown</i>			
Protozoa 047	8		0.29
	8	0.0000	0.29

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

DATA REPORT

A// 3 Yeeda Way
Malaga, WA 6090

P// (08) 9271 6776

F// (08) 9248 9120

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27588
Batch Number 150420113358	Sample ID SP6-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP6-S	Method (Detection Limit) Raw Count (1)	Analysis Date 28/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 102 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
176.0		176	15.1%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		23	13.07
		23	13.07
<i>Copepoda</i>			
Acartiidae		9	5.11
Calanidae		10	5.68
Copepod Nauplius		8	4.55
Corycaeidae		3	1.70
Oncaeidae		3	1.70
Sulcanidae		1	0.57
		34	19.32
<i>Gigartacontidae</i>			
Gigartacontidae		111	63.07
		111	63.07
<i>Sagittoidea</i>			
Chaetognath		7	3.98
		7	3.98
<i>Unknown</i>			

Species Name	Density	BioVolume	%
Protozoa 047	1		0.57
	1	0.0000	0.57

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27589
Batch Number 150420113438	Sample ID SP7-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP7-S	Method (Detection Limit) Raw Count (1)	Analysis Date 29/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 99 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
196.0		196	14.3%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		8	4.08
		8	4.08
<i>Copepoda</i>			
Acartiidae		6	3.06
Calanidae		56	28.57
Copepod Nauplius		13	6.63
Corycaeidae		41	20.92
Microsetella		10	5.10
Oncaeidae		9	4.59
Paracalanidae		2	1.02
		137	69.90
<i>Gigartacontidae</i>			
Gigartacontidae		18	9.18
		18	9.18
<i>Maxillopoda</i>			
Cirripede nauplius		5	2.55
		5	2.55

Species Name	Density	BioVolume	%
<i>Polychaeta</i>			
Polychaete larva	27		13.78
	27	0.0000	13.78
<i>Unknown</i>			
Protozoa 047	1		0.51
	1	0.0000	0.51

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27590
Batch Number 150420113516	Sample ID SP8-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP8-S	Method (Detection Limit) Raw Count (1)	Analysis Date 28/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 91 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
380.0		380	10.3%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian	11		2.89
	11	0.0000	2.89
<i>Copepoda</i>			
Acartiidae	29		7.63
Calanidae	151		39.74
Copepod Nauplius	62		16.32
Corycaeidae	33		8.68
Microsetella	16		4.21
Oncaeidae	8		2.11
Paracalanidae	6		1.58
Pontellidae nauplius	5		1.32
	310	0.0000	81.58
<i>Gigartacontidae</i>			
Gigartacontidae	32		8.42
	32	0.0000	8.42
<i>Polychaeta</i>			
Polychaete larva	21		5.53
	21	0.0000	5.53

Species Name	Density	BioVolume	%
<i>Sagittoidea</i>			
Chaetognath	1		0.26
	1	0.0000	0.26
<i>Unknown</i>			
Protozoa 047	5		1.32
	5	0.0000	1.32

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27591
Batch Number 150420113557	Sample ID SP10-S	Date Collected 13/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP10-S	Method (Detection Limit) Raw Count (1)	Analysis Date 28/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 106 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
236.0		236	13.0%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		4	1.69
		4	0.0000 1.69
<i>Copepoda</i>			
Acartiidae		23	9.75
Calanidae		77	32.63
Copepod Nauplius		55	23.31
Corycaeidae		39	16.53
Macrosetella sp. 001		1	0.42
Microsetella		1	0.42
Oncaeidae		18	7.63
Paracalanidae		3	1.27
Sulcanidae		8	3.39
		225	0.0000 95.34
<i>Polychaeta</i>			
Polychaete larva		1	0.42
		1	0.0000 0.42
<i>Sagittoidea</i>			
Chaetognath		6	2.54

Species Name	Density	BioVolume	%
	6	0.0000	2.54

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27592
Batch Number 150420113641	Sample ID SP11-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP11-S	Method (Detection Limit) Raw Count (1)	Analysis Date 28/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 106 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
1,316.0		1,316	5.5%
Species Name	Density	BioVolume	%
<i>Branchiopoda</i>			
Polyphemidae		1	0.08
		1	0.08
<i>Copepoda</i>			
Acartiidae		21	1.60
Calanidae		73	5.55
Copepod Nauplius		45	3.42
Corycaeidae		41	3.12
Macrosetella sp. 001		16	1.22
Microsetella		12	0.91
Oncaeidae		17	1.29
		225	17.10
<i>Foraminifera</i>			
Foraminiferida		11	0.84
		11	0.84
<i>Gigartacontidae</i>			
Gigartacontidae		1,077	81.84
		1,077	81.84

Species Name	Density	BioVolume	%
<i>Polychaeta</i>			
Polychaete larva	1		0.08
	1	0.0000	0.08
<i>Unknown</i>			
Protozoa 047	1		0.08
	1	0.0000	0.08

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27593
Batch Number 150420113723	Sample ID SP13-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP13-S	Method (Detection Limit) Raw Count (1)	Analysis Date 29/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 75 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
1,017.0		1,017	6.3%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		1	0.10
		1	0.0000
			0.10
<i>Branchiopoda</i>			
Podonidae		1	0.10
		1	0.0000
			0.10
<i>Copepoda</i>			
Acartiidae		1	0.10
Calanidae		7	0.69
Copepod Nauplius		40	3.93
Corycaeidae		17	1.67
Microsetella		6	0.59
Oncaeidae		4	0.39
Pontellidae nauplius		2	0.20
		77	0.0000
			7.57
<i>Gigartacontidae</i>			
Gigartacontidae		843	82.89
		843	0.0000
			82.89

Species Name	Density	BioVolume	%
<i>Polycystinea</i>			
Theoperidae	37		3.64
	37	0.0000	3.64
<i>Unknown</i>			
Protozoa 047	6		0.59
Protozoa 056	52		5.11
	58	0.0000	5.70

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27594
Batch Number 150420113821	Sample ID SP14-S	Date Collected 14/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP14-S	Method (Detection Limit) Raw Count (1)	Analysis Date 29/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 105 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
93.0		93	20.7%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		3	3.23
		3	0.0000
			3.23
<i>Copepoda</i>			
Acartiidae		14	15.05
Calanidae		4	4.30
Copepod Nauplius		16	17.20
Corycaeidae		37	39.78
Microsetella		6	6.45
Paracalanidae		5	5.38
		82	0.0000
			88.17
<i>Gigartacontidae</i>			
Gigartacontidae		7	7.53
		7	0.0000
			7.53
<i>Polycystinea</i>			
Theoperidae		1	1.08
		1	0.0000
			1.08

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27595
Batch Number 150420113908	Sample ID SP16-S	Date Collected 12/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP16-S	Method (Detection Limit) Raw Count (1)	Analysis Date 29/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 117 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty	
2,577.0		2,577	3.9%	
Species Name	Density	BioVolume	%	
<i>Appendicularia</i>				
Appendicularian		94		3.65
		94	0.0000	3.65
<i>Copepoda</i>				
Acartiidae		2		0.08
Calanidae		16		0.62
Copepod Nauplius		12		0.47
Microsetella		2		0.08
		32	0.0000	1.24
<i>Foraminifera</i>				
Foraminiferida		19		0.74
		19	0.0000	0.74
<i>Gigartacontidae</i>				
Gigartacontidae		2,412		93.60
		2,412	0.0000	93.60
<i>Polycystinea</i>				
Theoperidae		5		0.19
		5	0.0000	0.19

Species Name	Density	BioVolume	%
<i>Sagittoidea</i>			
Chaetognath	13		0.50
	13	0.0000	0.50
<i>Unknown</i>			
Protozoa 047	1		0.04
Protozoa 056	1		0.04
	2	0.0000	0.08

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species

Project BAROSSA COP-Barossa WQ Trip	Customer Jacobs Group (Australia) Pty Ltd Level 7, Durack Centre 263 Adelaide Terrace Perth, WA 6000	Analyst ID stuart Report Date 1/06/2015	DSID 27596
Batch Number 150420113957	Sample ID SP17-S	Date Collected 12/04/2015	
Monitoring Point	Sample Type Zooplankton	Date Received 20/04/2015	
Functional Location ID SP17-S	Method (Detection Limit) Raw Count (1)	Analysis Date 29/05/2015	
Units Reported: Cell Density: Individuals ⁻¹	Biovolume: mm ³ L ⁻¹	%: Percentage of total cells counted	

Sampler Notes

Laboratory Notes

Initial sample volume = 83 ml
Sample diluted 10x prior to analysis
3 replicate samples, 1 ml each, analysed

Field Data Recording

Total Density	Individuals ⁻¹	Total Counted	Uncertainty
966.0		966	6.4%
Species Name	Density	BioVolume	%
<i>Appendicularia</i>			
Appendicularian		34	3.52
		34	0.0000
			3.52
<i>Copepoda</i>			
Calanidae		3	0.31
Copepod Nauplius		29	3.00
Corycaeidae		10	1.04
Oncaeidae		21	2.17
Pontellidae nauplius		7	0.72
		70	0.0000
			7.25
<i>Gigartacontidae</i>			
Gigartacontidae		846	87.58
		846	0.0000
			87.58
<i>Polycystinea</i>			
Theoperidae		13	1.35
		13	0.0000
			1.35
<i>Unknown</i>			
Protozoa 047		3	0.31

Species Name	Density	BioVolume	%
	3	0.0000	0.31

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Shading Key
Potentially toxic species
Potentially harmful (non-toxic) species